SCIENTIFIC AMERICAN

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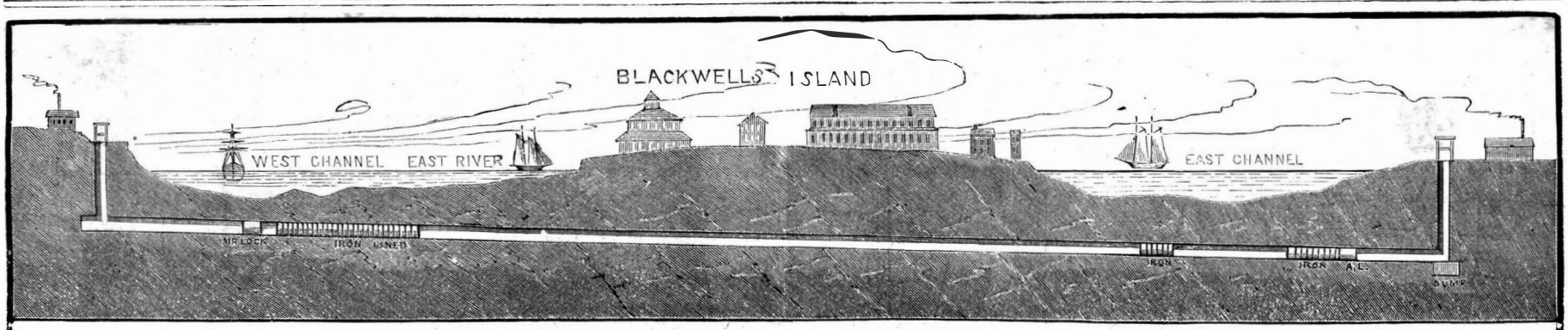

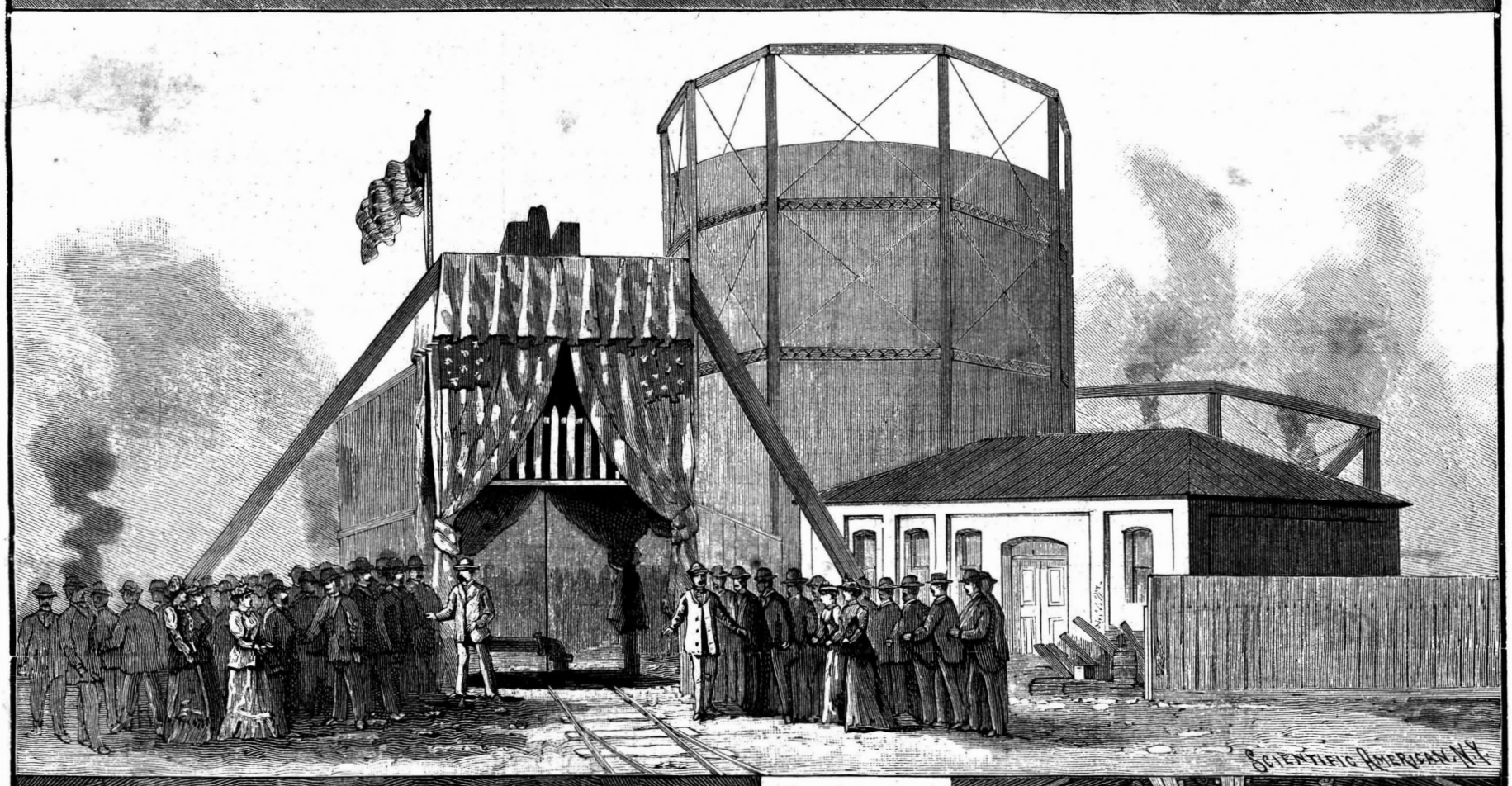

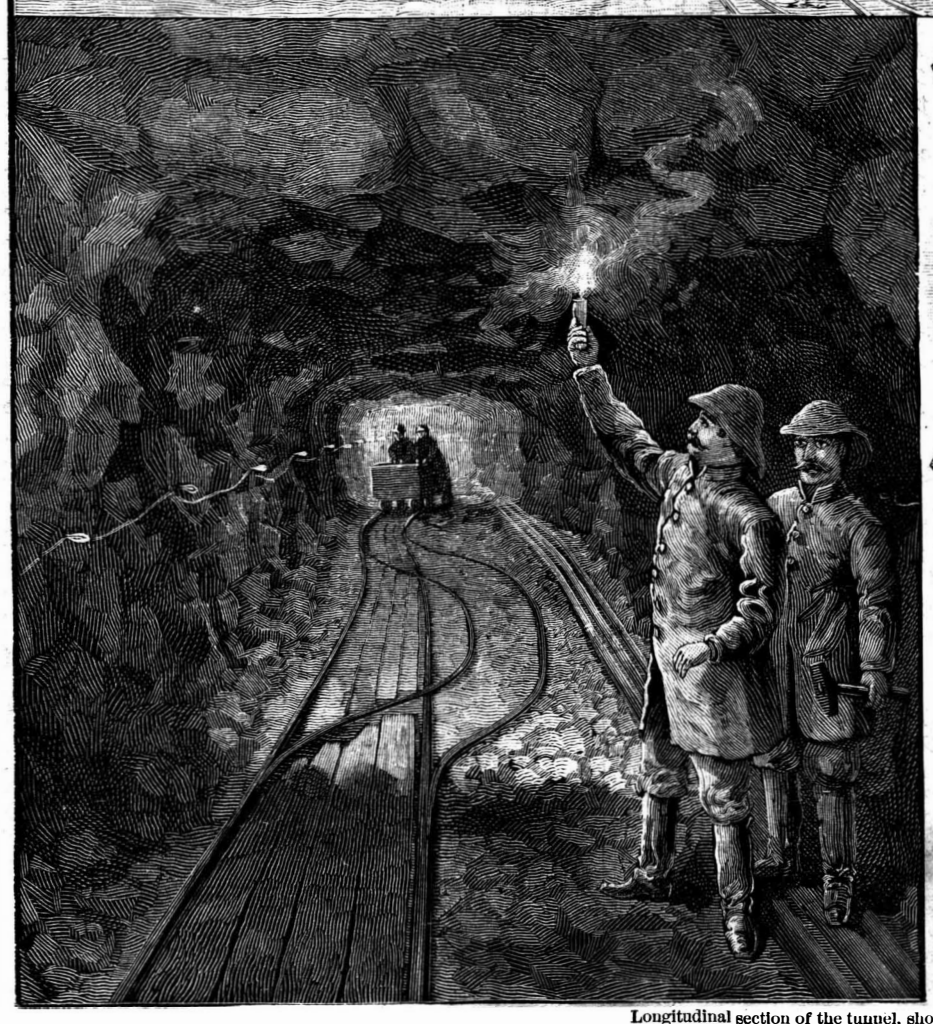

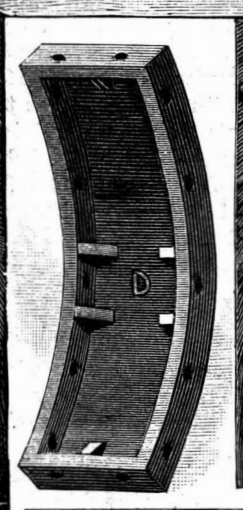

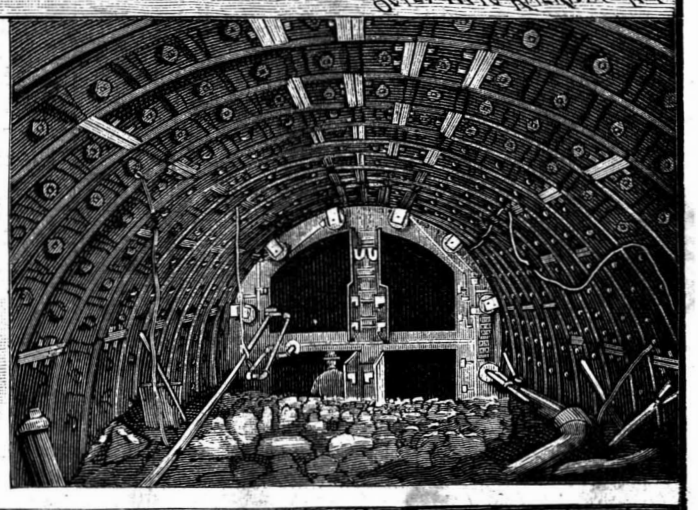

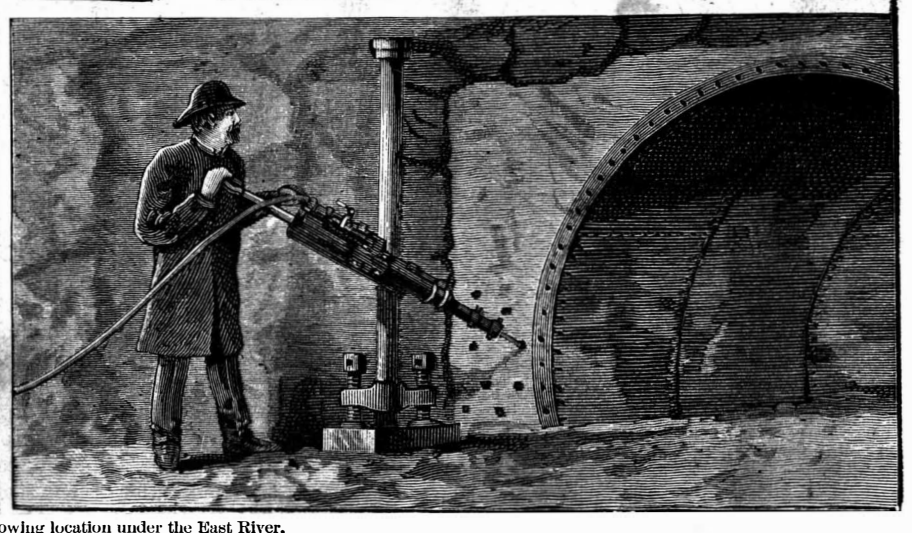

Longitudinal section of the tunnel, showing location under the East River.

Opening ceremonies at the Long Island City entrance to tunnel, on July 14.

The completed tunnel through rock formation.

A segment of the cast iron lining.

Interior of iron lined section, showing Beach shield in operation.

Drilling shot holes around an air lock.

TUNNEL RECENTLY COMPLETED UNDER THE EAST RIVER, AT NEW YORK CITY.—[See page 55.]

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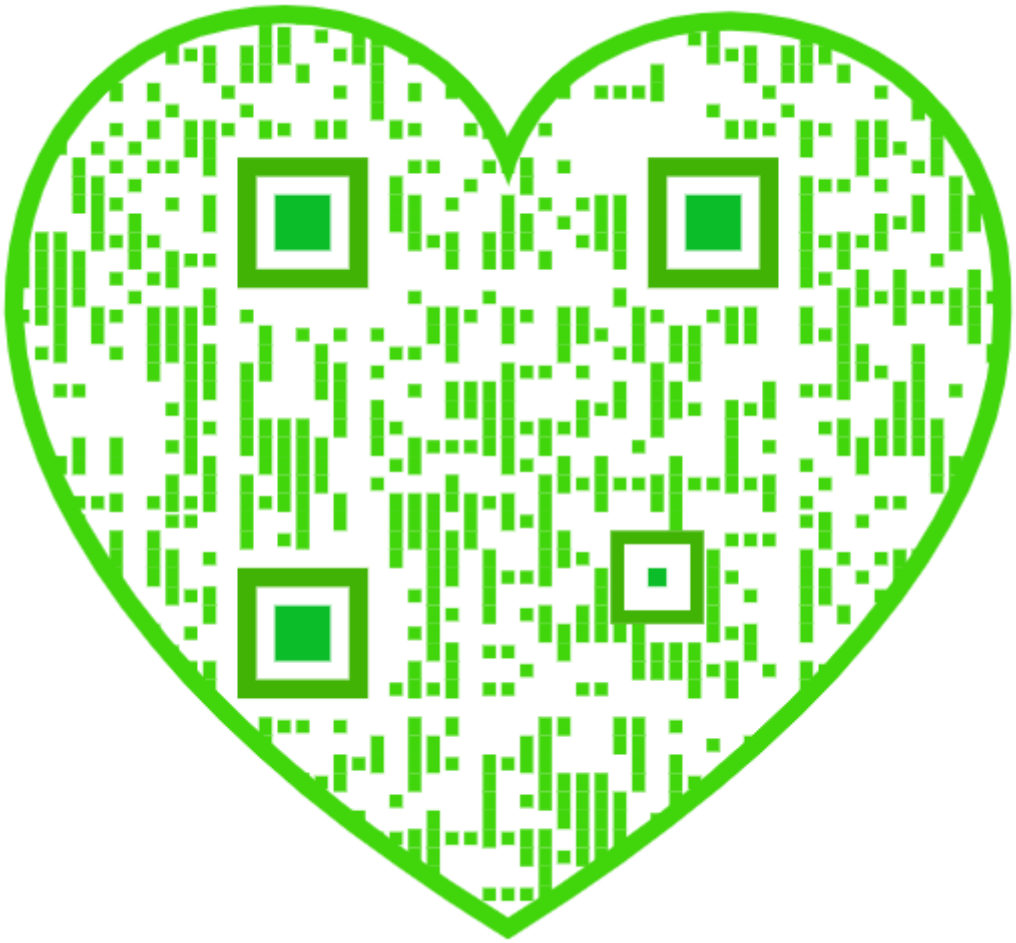

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NAVY SPEED TRIALS.

The interest felt by mankind in anything of the nature of racing has been recently fostered by speed trials in various branches of sport and engineering. In England the American yacht Vigilant has been repeatedly beaten by narrow margins by the English yacht Britannia. The admirers of the American boat find their consolation in hopes for the future, and in the fact that in one fair trial, devoid of calms and uncertainties, the Vigilant came out ahead. In cycling races are recorded as won by six inches, which is about the one-eightieth part of a second.

But while the sporting world is provided with its requisite pabulum and is given something to be interested in, a more serious field of competition has also occupied the public attention. The new ships of war built for the United States navy have been given speed trials which in the methods and in their execution may be considered an advance on anything of the kind hitherto carried out. For the government is no longer satisfied with a trial over a measured mile in smooth water.

The ship is taken to sea and is given a run of several hours' duration. The course is accurately measured or logged before the trial, and vessels are anchored along it to define it for the competing ship. The builders of the ship are given very large premiums for excess of speed over that contracted for, and the trial is carried out with every refinement that ingenuity can suggest to improve the ship's record. A perfectly clean bottom, selected coal, a special crew, the deck obstructed with as few objects on it as possible to avoid developing air resistance, all conjoin to get the last fraction of a knot out of the ship. In her after career she may never approach her trial record, on which her price was based.

This sounds unsatisfactory. If all ships, both here and abroad, were tried under identical conditions, then at least a comparative series of data would be obtained. But they are not. The English men-of-war have, when new, been tested in various ways, over different courses, and no standard can be appealed to for them. The same is the case here. While the present sea trial may be the most satisfactory yet developed, its value and interest is impaired by the very circumstance that it is a development. It does not afford a standard of comparison for any but the most recent ships.

Leaving aside purely naval ships, we come to merchant vessels. Such ships as the Minneapolis are supposed to be commerce destroyers. They will have to compete in speed with such ships as the Servia, Paris, New York, Lucania, Majestic, Teutonic, Columbia, Normannia, Furst Bismarck, ships which year after year ply on the Atlantic route with the utmost regularity and maintenance of the highest speed. These ships, too, have their speed trials, not over a short course, or of four hours' duration, but over nearly three thousand miles, and their speed trials may be said to be constant. What the Lucania would do on a four hours' trial is a matter of no interest to her owners. They want her to keep up her record over the ocean course, and her achievements there have a direct influence on her earnings.

As our war ships of the faster type may have to compete with such vessels as these, either in battle or in the *role* of commerce destroyers, it would seem proper that they should be tried under identical conditions. They should be fully equipped as if for war, and should then be sent over the much-traveled ocean lane between Sandy Hook and Queenstown. A run across, with the return run, would give new factors of speed, and would give data now quite unobtainable as to the real value of the new ships. Not the cleverest mathematician can determine from a four hours' run of a stripped ship what the same vessel would do with her guns, boats, and deck equipment in place and with ten days' coal on board over the ocean course.

It is much to be desired that the ocean course might be selected. The ship would then have a chance to develop any structural weaknesses in boilers or engines, and her coal and crew would represent a more just average than is given on the shorter trials.

Australia's Gold Fields.

Some big stories are current of the richness of the Coolgardie gold fields in Western Australia, and particularly of one mine in the district discovered by two young adventurers named Bailey and Ford. The former, while prospecting, found a 45-ounce nugget sticking out from a reef in a big mountain of quartz. As quickly a possible a claim was staked out, but, in spite of all precautions, much valuable surface ore was stolen before a proper guard could be established.

The monthly output from the mine now amounts to 2,000 ounces. From 30 tons of ore picked from a bulk of 1,400 tons, 18,000 ounces of gold was obtained, and the remainder of the stone is expected to yield from five to six ounces to the ton. Out of 650 tons raised from a depth of 15 feet, 12 tons were picked, giving 8,500 ounces of smelted gold. From another part of the mine four tons selected out of 100 tons of ore yielded 1,600 ounces of gold. Some of the other returns of picked stone were: Five tons from 250 tons for 2,000 ounces, two tons from 70 tons for 900 ounces, four tons for 1,000 ounces, and 35 hundredweight for 800 ounces. Some of the surface "is so rich in gold that ounces can sometimes be picked out in a few minutes." Down to the 50-foot level only it is estimated that gold to the amount of 40,000 ounces is now in sight. It is as yet too soon to speak about the prospects of other claims which have been pegged out in and around Coolgardie. Very few of them have got beyond the rudimentary stage of prospecting claims, although reports have been received of some valuable finds, among which may be cited a reef carrying ten ounces to the ton, and the discovery of nuggets of fifty-two ounce weight on a field forty five miles distant. The population of the place amounted to about 1,500 some weeks ago, but since then has diminished in consequence of the terrible hardships which must be encountered there, owing to the climate.

Fifty Millions in Silver.

The huge vault at the mint known as vault C, in which has been sealed up for nearly four years 50,000,000 of standard silver dollars, was opened a few days ago, and the long and laborious task of counting this big amount of money was begun. As the occasion was deemed one of importance, says the Philadelphia *Times*, there was observed some little formality. Dr. Caleb Whitehead had come on from Washington to represent the mint bureau; Frank Sartori represented Superintendent Townsend; and W. L. Bosbyshell, Col. Bosbyshell's son, represented the former superintendent. William E. Morgan, United States Treasury examiner, was also present. United States Treasurer Daniel N. Morgan, who, with his son, happened to be in this city, and accompanied by Major Worman, witnessed the breaking of the seal and afterward made a tour of inspection of the mint.

Major C. H. Townsend, cashier of the mint, having been given the combination of the vault, proceeded to open the door. This was easily accomplished, but when the inner door was reached some difficulty was experienced, as even after the combination lock was manipulated, the door refused to open, the bolts from long disuse sticking fast.

This was soon overcome, however, entrance was finally effected, and the assembled officials stepped within the inclosure where lay piled up millions. On the inside door, fastened by sealing wax, was a sheet of foolscap paper containing the statement that $33,000,000 had been placed there on February 7, 1890, with Major Meline, of the treasury; B. F. Butler, of the mint bureau, and James C. Eyster, of the mint, present, and that further, $17,000,000 more had been sealed up on May 26, 1891.

The vault emitted a damp, musty odor when opened. Under the glare of the electric light the great wealth of stored silver was visible. There it lay in bags just as it had been placed. There were 50,000 bags, each containing $1,000 in shining coin. These bags were piled up one on top of the other, the topmost almost reaching the arched ceiling of the vault, nearly nine feet high. The whole mass had been arranged in different stacks. The first stack was thirteen bags high and eight across. Just in the rear of this was a second stack, while still further back loomed up a third. This, though, represents only one section of the vault. Altogether there are nine. The weight of this great amount of silver is 2,850,000 pounds avoirdupois, and the tremendous pressure of the upper bags upon the lower had caused a number of the latter to burst, causing their glistening contents to spread out upon the floor.

Inoculation for Cholera.

According to the *British Medical Journal*, three further remarkable instances of the success of Prof. Haffkine's system of anticholera inoculation are reported from Calcutta. In the first case, four out of the six members of a family were inoculated last March. The cholera appeared in the neighborhood lately, and the disease attacked one of the two who had not been inoculated, while the inoculated remained free. In the second case, five members of a family consisting of eleven persons were inoculated in March. The cholera lately attacked one of the six who had not been inoculated. In the third case, six out of a family of nine were inoculated. When the cholera prevailed in the neighborhood a few days later, the disease attacked one of the three not inoculated. It is stated that the corporation of Madras has passed a resolution inviting Prof. Haffkine to visit that city and introduce his system.

Laundry Glaze.

French chalk	35 pounds.
Barilla ash soap	2 "
Borax	½ pound.
Resin	¼ "
Water	15 pounds.

This mixture is dried and powdered, or made into a paste, if desired.

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The Poultry Industry in China.

The breeding and rearing of fowls is an important industry in China, as they form a very considerable portion of the daily food of the better class of the people. The United States consul at Chin-kiang says that the varieties of fowls are few in number. The principal are the Yangchow fowl, a large bird of good flavor, which weighs from four to six pounds. This variety is a good layer and sitter, the eggs being of brownish tinge and good size. It lays, during eight or nine months of the year, about 200 eggs, ceasing only in the hot summer months. This description is kept more for the table than for laying purposes, as its flesh is particularly good. The Langshan fowl is a distinct and fairly pure breed from the Yangtze River region, just below Chin-kiang. It is a large, heavy, handsome bird, weighing from seven to eight pounds. The eggs are of darkish brown, and of good size. The Black Bone or Typhoon chicken is a distinct fancy breed. In color it is white, and its skin, legs, bones, flesh and comb are very dark. The flesh of this fowl is much esteemed, and, boiled down into soup, it is prescribed by physicians for certain diseases. The Chow is another variety. This breed is small, weighing generally from two to three pounds. A pure white cock of this breed is always carried on the coffin at a native funeral *cortege*, and is sacrificed at the grave. Also on native boats a cock bird is killed on the Chinese New Year's day, and the blood sprinkled on the bow to propitiate evil spirits, and to insure good luck during the year. Ducks are reared in great quantities, and are largely used as food, both fresh and salted. They are all artificially hatched, as the duck is an uncertain sitter. The common duck is a good sized bird, weighing, when dressed for the table, three or four pounds, and is much esteemed for the excellence of its flavor. After fledging, the birds are driven about in vast flocks through canals, and from pond to pond, where they find their food. They are brought under strict discipline, and obey their keeper's call with extraordinary intelligence. The Mandarin duck is smaller than the common duck, and is a beautiful bird, with diversified and brilliant plumage. It is reared chiefly for its beauty. In the grounds of the wealthy there is always an artificial lake, where the Mandarin duck is kept. They are considered as emblems of conjugal fidelity, and a pair of them usually form a part of wedding processions. Preserved ducks' eggs are considered a delicacy, and always form an important part of a mandarin dinner. The process of preserving them is as follows: A lye of beanstalk and lime is made by burning these to powder. This is put in water, black tea leaves and salt in certain proportions being added. The boiling is continued until all the water has evaporated, and the residue becomes caked and hard. This is powdered fine, and the fresh eggs are placed therein one by one with a little rice husk. They remain in this preparation one hundred days, when they are ready for use. The preserved eggs will keep for several years. When ready for use they have the appearance of hard boiled eggs. The shell is taken off, and they are put on the table cut into small slices and eaten as *hors d'œuvres*. The goose is generally of pure white plumage, very striking in appearance, of great size and majestic carriage, much resembling the swan. The turkey has long been introduced into China, and is reared at Canton and Tien-Tsin entirely for foreign markets, that is, for the foreigners at the treaty ports. The peacock is reared in many parts of China, and has long been known to the people, though it is not a native of the country. Its tail feathers are used by the mandarins in their caps to designate official rank.

The gold and silver pheasants of China may be called domesticated birds, as they are now so extensively reared that it is doubtful if they are found wild. There is a bird in China—the cormorant—which is domesticated, trained to wonderful intelligence, and employed in catching fish. These birds are reared and trained with great care. A pair costs from five to six dollars. They are taken out on the lakes and rivers in a small boat; one man to every ten or twelve cormorants. The birds stand perched on the sides of the boat, and, at a word from the man, they scatter on the water and begin to look for fish. They dive for the fish and then rise to the surface with the fish in their bills, when they are called back to the boat by the fisherman. As docile as dogs, they swim to their master and are taken into the boat, when they lay down their prey and again resume their labor. The use of incubators in hatching eggs has been known and practiced in China for several hundred years. It is a large and profitable industry, but the apparatus used is of a very primitive description. The hatching house is usually a long shed built of bamboo, the walls plastered with mud and thickly thatched with straw. Along the ends and down one side of the building are a number of round straw baskets plastered with mud to prevent them from taking fire. A tile forms the bottom of each basket. Upon this the heat acts, a small fireplace being below each basket. Upon the top of the basket there is a straw cover, which fits closely, and is kept shut during the process. When the eggs are brought they are put in the baskets, the fire is lighted beneath them, and a uniform heat maintained. In four or five days after the eggs have been subjected to this temperature, they are taken carefully out, one by one, to a door, in which are a number of holes nearly the size of the eggs. They are held against these holes, and the attendants, looking through them, are able to tell whether they are good or not. In nine or ten days after this, that is, about fourteen days from the commencement, the eggs are taken from the baskets and spread out on shelves. Here no fire heat is applied, but they are covered over with cotton and a kind of blanket, under which they remain about fourteen days more, when the young chickens break their shells and come forth. The natives engaged in this business know exactly the day when the young chickens or ducks will come forth, and are ready for their arrival. They are generally sold two or three days after they are hatched.

The Pullman Strike.

It is to be regretted that the people of the United States should have to recover the use of their ordinary highways at the point of the bayonet, but it is better to recover and hold them in that way than to give up the control of them, even for a moment, to people so reckless and malicious, or so unutterably base, as those who have managed the great railroad strikes for the past ten years. The example of the Pullman strike shows how false and dangerous are the doctrines in regard to workingmen which have gained so much credit and wrought so much misery within the present generation. According to those doctrines, a man who works with his hands is not a man, but a babe, who must be provided with a clean house, not through the process of cleaning it with his own hands, but by having philanthropic people get up a subscription to hire some one to clean it for him; who must be amused with lectures, picture shows, and other distractions, at the expense of the public, or of amiable private persons, and whom it was right to encourage in every way to think that thrift, industry, sobriety, and self-denial were no longer necessary to one so favored, and that yelling and kicking, if long enough continued, were sure to bring him everything to which he might take a fancy. The lesson has not been lost: the babe of the nineteenth century, trained by the lullabies of the political economists, the dandling of the politicians, and the patient indulgence of the more rational part of the community, to combine the greedy helplessness of the infant with the strength and malice of the man, claws every day more viciously at what does not belong to him, and tramples more recklessly on the rights of other people. In the end, these rights must assert themselves, or perish in the worst of tyrannies; but a part of the harsh lesson by which they are defended should be reserved for the moonstruck philosophers and sentimentalists who have taught ignorant people that, instead of relying on their own exertions for improving their condition, looking out only to preserve and extend their freedom to use those exertions, they were entitled to trample on the freedom of others in order to get what they wanted.—*American Architect.*

The Great Sea Mammals.

Captain Scoresby relates how one of his harpooners, having struck a young whale in order to secure the mother, saw her instantly rise, wrap her clippers round her young one, and descend, dragging about 600 feet of line out of the boat, with marvelous force and velocity. Again she rose to the surface, darted furiously to and fro, frequently stopped short, or suddenly changed her direction, giving every possible intimation of agony. The boats continued to pursue her closely for a length of time, while she, poor creature, seemed utterly regardless of the dangers which surrounded her. At last one of the boats approached so near that a harpoon was thrown at her, then a second harpoon, and a third; still she did not attempt to escape, but allowed the other boats to approach, so that more harpoons were attached, till in the course of an hour the poor animal was killed. Though there was something painful in the deliberate destruction of a creature evincing such heroic affection for her offspring, yet this feeling of compassion quickly gave way to the object of the adventure, the value of the prize, and the exciting joy of the capture. The fidelity of the male and female whale to each other exceeds that of most animals. Anderson, in his "History of Greenland," mentions that some fishermen, having struck one of two whales, a male and female that were in company together, the wounded creature made a long and terrible resistance. With a single blow of its tail it upset a boat containing three men, by which they all went to the bottom. When another boat came up, the other whale still remained by its companion, and lent every assistance, till at last the wounded victim sank under the number and severity of its wounds, while its faithful partner, unable to survive its loss, stretched herself upon the dead body of her mate, and calmly shared its fate.

To the Greenlanders, as well as to the natives of southern climates, the whale is an animal of vast importance; and these people devote much of their time to fishing for it. When they set out upon their whale catching expedition they dress themselves in their best apparel, imagining that if they are not cleanly and neatly clothed, the whale, which detests a dirty slovenly garb, would certainly avoid them. In this manner about 50 persons, men and women, set out together in one of their large boats. The women take with them their needles, thread, and other implements, to mend their husbands' clothes, in case they should be torn, and to repair the boat if it should happen to receive any damage. When the men discover a whale they strike it with their harpoons, to which are fastened tubes two or three fathoms long, made of sealskin inflated with air. The huge animal, by means of this kind of bag, is in some degree compelled to keep near the surface of the water. When he is fatigued and rises, the men attack him with their spears until he is killed. They then put on their spring jackets, made all in one piece, of a dressed sealskin, with their boots, gloves, and caps, which are laced so tightly to each other that no water can penetrate them. Thus attired they plunge into the sea and begin to slice off the fat all round the animal's body, even from those parts that are under water, for, their jackets being full of air, the men do not sink, and are able to keep themselves upright, standing, as it were, in the sea.

At Vancouver's Isle the winter storms blowing directly from the North Pacific bring many whales which, getting out of their latitude and fatigued with fruitless struggles, are cast upon the coast; as the receding tide leaves the whales, they lash their tails, unable to regain deep water, and make a low guttural sound as they vainly try to spout. The native canoes, which are made of the trunk of a tree hollowed out by fire, are instantly launched. The only weapon used is a barbed spear, to which is tied a sealskin bag filled with air, and to this a rope made of seaweed is attached, acting as an anchor to the bladder or rope. A pole is fitted into a socket in the spear head, and so arranged that it can easily be withdrawn, leaving the head embedded in the body of the whale. Armed with both these primitive weapons, the natives set off in their fragile canoes and cast their spears, catching back the loose handles. In a short time the monster is covered with sealskin bags. When the tide begins to rise, the bladders prevent the whale from sinking sufficiently to use his full strength, keeping him on the surface of the water. As the canoe men pull to the shore the lines are tightened, and gradually the poor animal moves slowly and steadily to the land. His struggles to free himself are tremendous, but all in vain; struggling as a fish out of water, he is hopelessly in the power of his Liliputian foes. The inhabitants for miles around crowd to the shore, singing and beating drums made of the hollow bole of a tree over which is stretched the skin of a sea-lion. As soon as the whale is brought beyond low-water mark the work is done, and they have only to wait till the tide leaves it high and dry.—*Month.*

Phosphorescence.

Mr. Herbert Jackson, in a paper read before the Chemical Society, dealt first with the readiness with which the phenomena of phosphorescence may be studied by using a mechanical pump capable of very rapidly giving high vacua (Fleuss' pump). The author considers that in many cases the phosphorescence cannot be ascribed to impurities, but that a presumably pure substance yields in several instances phosphorescence of different colors. The main portion of the paper is occupied with an attempt to show that the phenomena of fluorescence, phosphorescence in air on exposure to light, and phosphorescence of substances in a vacuum under the influence of the electric discharge, are of the same nature, viz., a response on the part of the substances to the operation of radiant energy propagated after the manner of light in undulations of short length. These undulations proceed from the electrode, and to them the gas in the tube responds, giving rise to the visible light in the gas. To this light some phosphorescent bodies respond, but others require to be affected by the very short undulations to which air is opaque. Such substances, therefore, only phosphoresce in high vacua. These conclusions are based on experiments made with a "jar spark" in air acting upon phosphorescent substances placed in the appropriate foci of a quartz lens; on the study of the behavior of such substances outside a vacuum tube provided with a quartz window, and also on their behavior inside the vacuum tube. The results of a very large number of experiments seem to indicate a close connection between the phenomena of phosphorescence of air and in a vacuum, broken only when the opacity of quartz to some undulations and of air to others interferes.

CERTAIN species of ants make slaves of others. If a colony of slave making ants is changing the nest, a matter which is left to the discretion of the slaves, the latter carry their mistresses to their new home. One kind of slave making ants has become so dependent on slaves, that even if provided with food they will die of hunger unless there are slaves to put it in their mouths.

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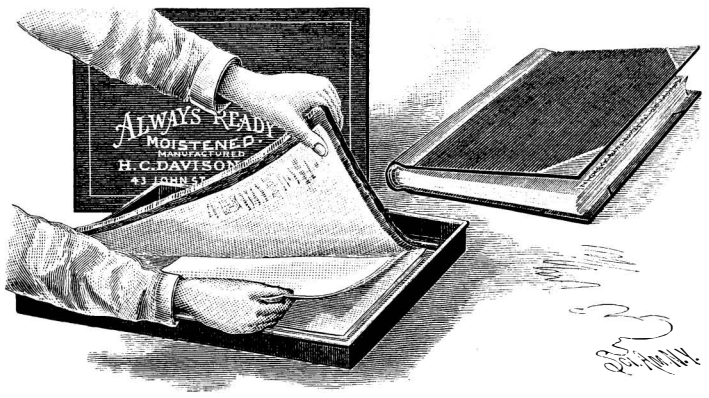
DAVISON'S "IMPERIAL FIBER" LETTER COPYING BOOK.

A non-blurring copying book, used for press copying of type-written and pen-written matter alike, and affording beautifully clear and distinct copies, is manufactured by Messrs. H. C. Davison & Co., of No. 41 John Street, New York City, from a special character of copying paper, known as "Imperial Fiber."

These books are used in exactly the same manner as the ordinary copying books; the peculiarity and great advantage being in the fact that the copies will not spread or blur on this special paper, even though the leaves may be extra wet.

An apparatus for properly moistening the leaves of copybooks, to insure uniformly good copies, is made by the same firm, and is shown in the illustration. It consists of a japanned tray with cover, two heavy felt sheets for moistening, and a dozen patent copying sheets, the latter being each composed of two layers of stuff, between which is another of absorbent vegetable parchment drawing moisture from the felts and keeping the sheets evenly moistened and always ready for use. These sheets are sufficiently thin to enable users to copy a large number of letters at one time.



DAVISON'S "IMPERIAL FIBER" LETTER COPYING BOOK.

THE CASTLE OF BONNETABLE.

In Sarthe, at some distance from Mamers, and upon the railway that connects the latter with Saint Calais, stands, in the small city of Bonnetable, the castle built in 1742 by the architect Mathurin de Landelles upon the site of a former castle erected in the twelfth century by the lords of Montfort l'Amaury. An edifice often loses all unity and all charm in the successive alterations of which it is the object. It is with it, as it is with those coins which, having been passed from hand to hand for several generations, become smooth to the touch; the relief has disappeared.

Bonnetable has fortunately been preserved from so lamentable a fate. From the d'Harcourt family, which, in the thirteenth century, entered into possession of the fief, and one of the members of which, Jean d'Harcourt, had undertaken the construction of it, it passed into the hands of the Bourbon family and then into those of the de Luynes family. In 1788 it came into the possession of Duke Mathieu de Montmorency. At present it belongs to Duke de la Rochefoucauld-Doudeanville, who, in recent years, has had it restored by two Parisian architects, Messrs. Henri and Louis Parent.

The first castle, the one at least that Mathurin de Landelles constructed, includes two facades of analogous dimensions. The principal facade, flanked at its extremities by huge cylindrical towers, crowned by a projecting *chemin de ronde* which is prolonged upon the entire facade, and covered with a conical slate roof, has the aspect of the entrance of a fortified castle. It is pierced in its center by a great ogival dome contrived in the base of a square donjon of quite feeble height, above which rises a pyramidal roof, surmounted by a light woodwork belfry. To the right and left of the entrance, protected by a drawbridge and closed by a portcullis, there are two towers smaller than the corner ones, and also cylindrical and covered by the same pepper-box-like roof. The rest of the facade is composed of a high ground floor, lighted by large, square balustered windows, the upper part of which is ornamented with the traditional curved lines. Above the ground floor is the first story, the windows of which, starting from the base of the *chemin de ronde*, and surmounted by high gable ends, rise to the ridge of the roof.

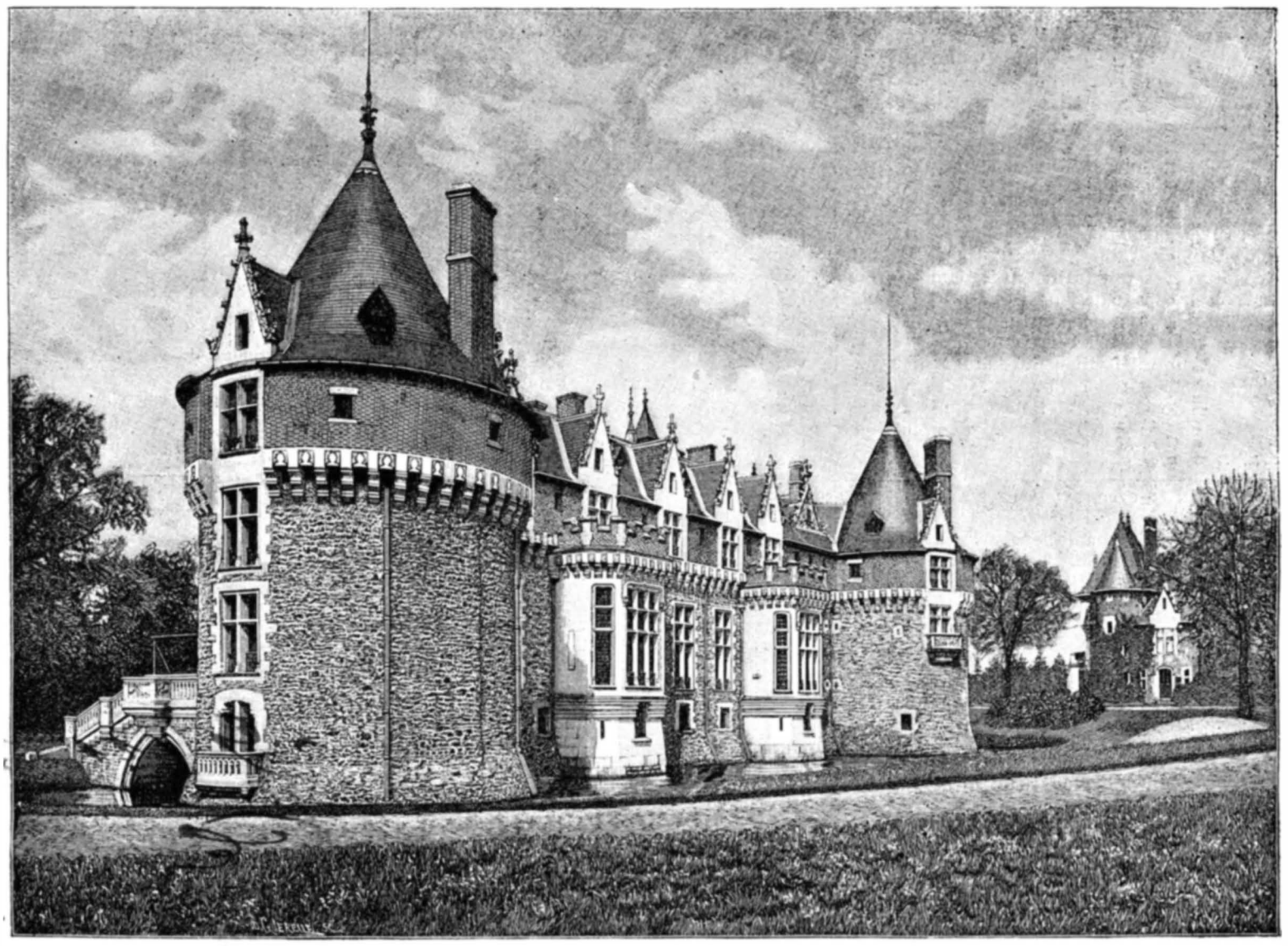
These windows, identical as to form with the windows of the ground floor, are the only ornamented part of the edifice. Their ornamentation, entirely Gothic, is, moreover, of the simplest nature. It is, nevertheless, in most exquisite taste. Their triangular tympan has a grand appearance under their framing of crocketed gables, surmounted by a flower at the point and bordered with symbolical animals at the base.

The decoration is the same for the lateral facade, which, like the principal one, is flanked by a huge corner tower, and, like it, bathed in a wide basin. But while the principal facade has, without any modification, preserved its severe aspect of former times, the lateral facade has, during the course of the last work of restoration, undergone a few modifications designed to render it more habitable. The windows of the corner towers have been provided at the base with elegant little balconies, supported by sculptured brackets and provided with openwork balustrades. In the space comprised between the towers the rigidity of the straight line is broken by two bay windows with six sides—a sort of projecting turrets containing large windows, but which do not exceed the height of the ground floor, and the upper part of which forms an embattled terrace, upon which, in guise of balcony, open the windows of the first story. This is the facade that is represented in our engraving.

So much for the primitive part. As the castle in this form was not sufficient for a large family and for a *personnel* still more numerous, some enlargements became necessary. It became a question of constructing a new wing in complete harmony with the old edifice, without changing anything in the primordial plan. The architects have acquitted themselves of this task with rare skill. At the other extremity of the principal facade they have constructed a new main building, parallel with the ancient wing, but of more limited dimensions. This building, which has the form of a long quadrilateral, and which rises from the foundations of the destroyed wings of the castle constructed by the lords of Montfort l'Amaury, presents the aspect of a donjon, which is connected wonderfully well with the rest of the edifice. At the point of connection of the corner tower and the new donjon the architects have constructed a chapel, whose apsis projects over the basin.

Such is the castle in its present state. But the description would be forcedly incomplete did we not speak of the inclosing wall, which extends in front of the principal facade of the castle, upon the street (for the property is situated in mid-city), and the construction of which, very ingeniously combined, does the greatest honor to the Messrs. Parent. It is an embattled wall in which, opposite the postern of the castle, opens a lattice-work gate flanked by high masonry pillars. Let us add that although the castle has preserved none of its ancient furniture, the internal arrangement has not been sensibly modified. One feels that the present arrangements have been made by the Duke of La Rochefoucauld and his architects with a religious respect for the past. They cannot be too highly felicitated.—*Magasin Pittoresque.*

IN a paper on the Laval steam turbine, read before the French Society for the Encouragement of National Industries, it was stated that, though invented only in 1891, some 200 of the motors are now at work, ranging in size from 5 to 100 horse power. The speed of rotation ranges from 15,000 to 30,000 per minute, the steam issuing from the guides at the full speed due to its pressure. Owing to this it is not necessary that the wheel should fit closely into the guide chamber, as there is no tendency to leakage, and, as a matter of fact, a clearance of about ⅛ inch is allowed between the two. There being this clearance, the wheel cannot jam as it might otherwise do mounted as it is on a very flexible shaft.



THE CASTLE OF BONNETABLE.

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The Atmosphere of the London Underground Railway.

In the House of Commons, recently, Mr. Weir asked the president of the Board of Trade whether his attention had been drawn to certain articles and correspondence in the *Pall Mall Gazette* as to the state of the atmosphere in the underground railway and the means of purifying it; and whether he would take steps to deal with the matter effectually.

Mr. Bryce: I have myself had such frequent and painful experience of the state of the atmosphere in certain parts of the underground railway that no newspaper articles could make me feel more strongly than I do the inconvenience from which the public now suffers. But Parliament has not intrusted the Board of Trade with any powers which would enable them to deal effectually with the mischief of which my honorable friend complains.

THE ACCIDENT TO THE STEAMER PLYMOUTH.

Last June the splendid steamer Plymouth, of the Fall River line, plying on Long Island Sound, between New York and Fall River, went ashore on the rocks off Rose Island, R. I., in a dense fog. For six days she remained there, resisting all attempts to remove her, but was finally floated off and made the trip to New York under her own steam. Here she was placed in the dry dock for repairs. Our engraving is from a photograph specially taken for the SCIENTIFIC AMERICAN while the boat was on the dock. It shows the appearance of the hull after the damaged outer plates had been removed. It illustrates what a remarkable provision for safety the double hull used on the iron boats of this company is, and also the fine quality in the material used. The damage in brief amounted to this. For a considerable distance on each side of the keel about amidships the plates were bulged, cracked and broken, and thirteen of her twenty-two compartments in the double bottom were open, so that it was calculated that 450 tons of water entered. The inner hull was intact.

It was found that little water entered it, and that the leakage was confined to the outer hull. One very interesting point brought out in the illustration is the fact that the plates connecting the two hulls were only injured in their lower portions. In executing the repairs the lower portions were cut off and replaced by new pieces, but the upper portions of these connecting plates are as good as ever. The accident was a striking tribute to the excellence of the material and the great safety afforded by the double hull.

The Plymouth is a magnificent specimen of marine architecture. She is 351 feet 8 inches long and of 50 feet beam. Over the guards her width is 86 feet. She is driven by triple expansion inclined engines, and throughout is replete with the latest improvements. Her engine is of 5,000 horse power. A more detailed description of the boat, with illustrations, will be found in our issue of October 4, 1890.

A CHINESE GAME.

What is called the "Game of the Devil" dates back in China, where it is called *Kouen-gen*, to a very remote antiquity, and has been much played in France at

THE GAME OF THE DEVIL.

different epochs of modern times, especially at the beginning of the present century. One of our readers, Mr. W. Taylor, sends us an interesting photograph relating to the operation of the apparatus used, and which we reproduce herewith.

It represents the "devil" thrown into the air by means of a string that the player keeps taut by means of two sticks and upon which he is to catch it. "I remember having often seen this game in the hands of one of my friends," says Mr. Taylor. "According to him, the game was in great favor in Belgium in his boyhood, about fifteen years ago, especially at colleges, where the young men often got up genuine matches between two and even three players. I send a photograph taken with a kodak and which represents a player at the moment in which the 'devil' is returning to fall back upon the string. The form of the devil varies a little from that of the 'Kouen-gen.' It is made of two tin cones, connected by their apices and provided with apertures for the production of a humming sound when the devil revolves very fast. A good strong player can easily throw it to a height of more than forty feet."

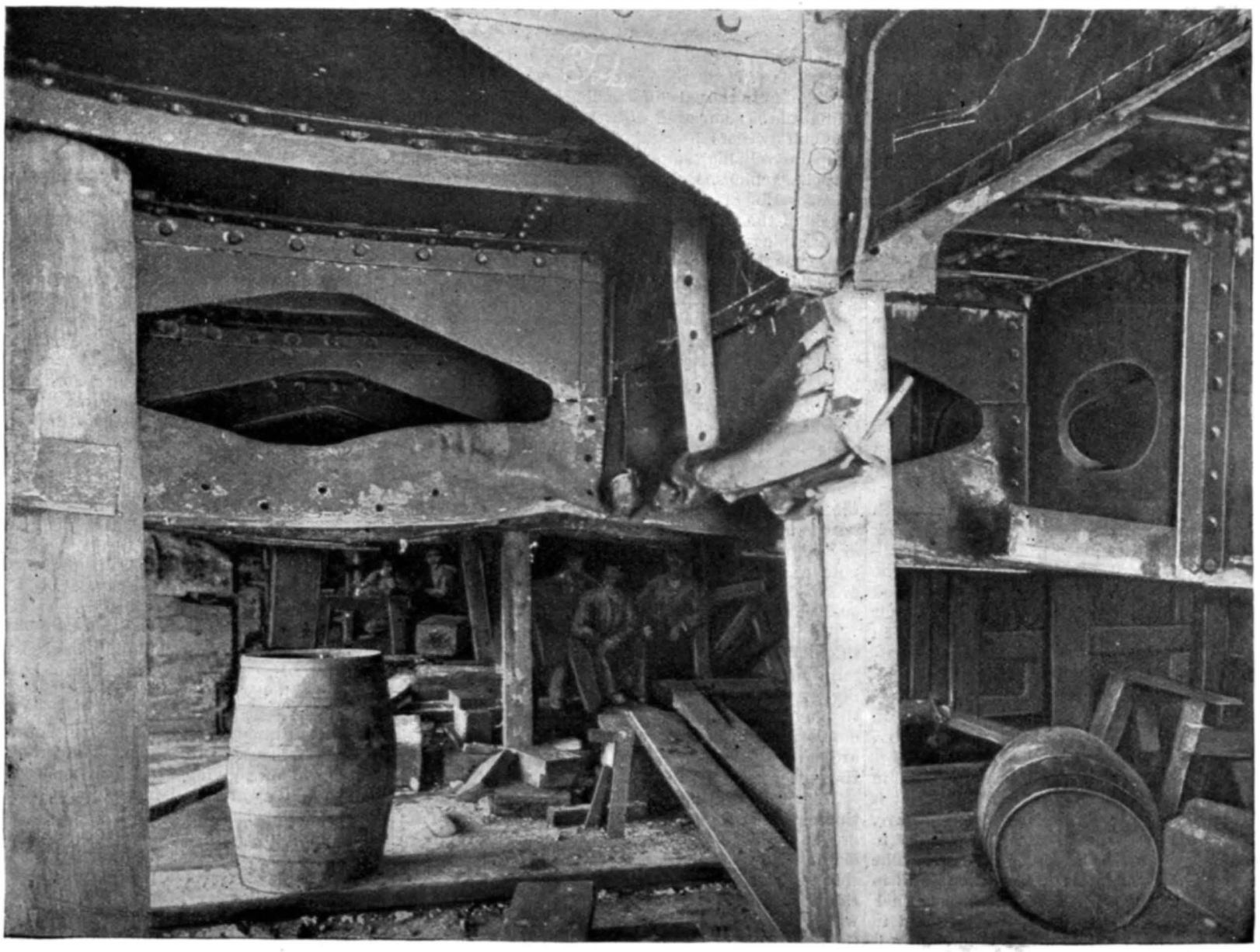
In our childhood (along about 1853), this game was much played at Paris. The devil was made of two hollow boxwood balls. This game, which is very amusing, and which tries one's skill, is now almost forgotten. It would be interesting to bring it into vogue again.—*La Nature.*

A New Electric Locomotive.

An electric locomotive of 1,000 horse power is (says the *Engineer and Iron Trades Advertiser*) under construction in London, from the plans of Sprague, Duncan & Hutchinson, to the order of the North American Company. It is intended for slow speed and heavy traction in switching service. The machine is carried upon four pairs of driving wheels, all coupled. The frame is of steel, with deep pedestals. The 56 inch wheels are close coupled; the first and last pairs only are flanged. There is a motor in each axle, the weight of the armature coming directly on the wheels, and that of the field magnets is on the journals through the pedestals; no spring supports are used. The four motors all form parts of a complete system on a rigid wheel base of 15 feet. The motors are of the alternating type, are wound for 860 volts, at 225 revolutions, which will be the equivalent of 35 miles an hour when in multiple.

The Telescope of the Future.

At the Royal Institution Sir Howard Grubb in a lecture recently discussed the great telescopes of the future. The main point of his new proposal is to mount a colossal instrument so that it practically floats on a liquid support. In this way even the greatest reflectors and refractors could be properly sustained. They would, it is believed, move with a smoothness and steadiness not attainable with supports ordinarily employed. By this method Sir H. Grubb proposes to render the large telescopes more suitably adapted for photographing the heavens. In the ordinary visual use of the telescope slight irregularities in the movement of the instrument are merely inconvenient, but for the accurate demands of photography absolute precision in movement is required. When this is wanting the result of the photograph is to represent each star as a streak instead of a round sharp dot, which the properly exposed plate should produce.



DOUBLE HULL OF THE STEAMER PLYMOUTH.

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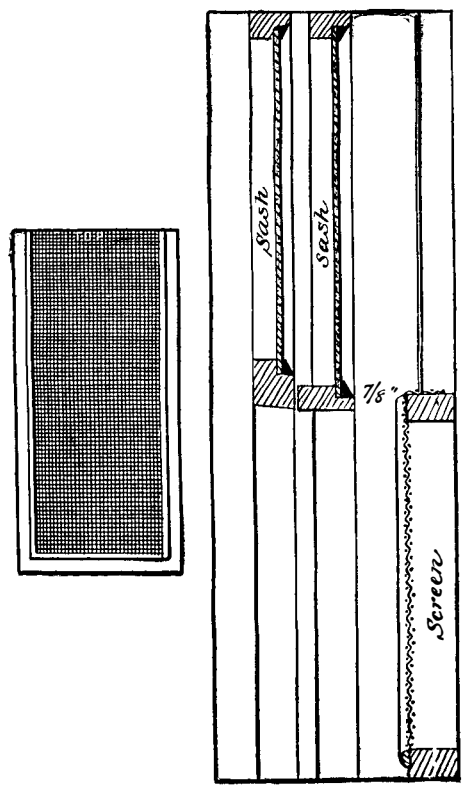
Correspondence.

A WINDOW SCREEN WHICH ENTICES FLIES OUT OF A ROOM.

To the Editor of the Scientific American:

I have five windows in my office and would like to tell the subscribers of the SCIENTIFIC AMERICAN how to put in window screens and not have any flies in their rooms. Give the fly a chance on such a screen, and he will go out. First place the frame on the outside of the window, the wire to be on the inside of the frame. Nail on moulding at each side and at the bottom to cover the ends of the wires, but let the wire cloth extend over and nail on top of the frame. Put no moulding at the top on the inside. If you will give the flies a chance, they will alight on the screens and walk up and out. Take any common window screen and place it on the outside, but instead of closing the space at the top, take a hammer and pull the top moulding off from the screen; let the space then be open between the top of the screen and the sash, as shown in the accompanying sketch. When you draw down the window shade half way, or down to the top of the screen, and the open space thus left across its top, you will see the flies go toward the light and walk up the screen and go out. All the flies that come in



from the screen door when it is open go to the window screens and thus go out. G. P. YULE.

Clinton, Ia.

The Cave Dwellers of Mexico.

Doctor Carl Lumholtz, the distinguished explorer and author of "Among Cannibals," has been for the past three years making explorations in the almost unknown regions of the Sierra Madre, in Mexico. He has written several papers on his discoveries for *Scribner's Magazine*, the first of which appears in the July number, under the title "Among the Tarahumaris." These people are fundamentally different from the cliff dwellers of the Southwest; they are cave dwellers, and among them many strange customs, Christian and pagan ceremonies survive side by side.

I have seen heathens [he says] living in wooden shelters near their corn fields, while only five hundred feet lower down they had a large cave where they found it more pleasant to spend the winter; but generally the caves used as winter resorts are found much farther from the high ridges. Heat is no drawback to a Tarahumari, and therefore permanent cave dwellers may be found even down in the hot barrancas. The heathen in the barrancas cultivates corn, beans and tobacco, but upon a small scale, owing to the fact that the soil is scarce, and he has to build stone walls in order to retain his scanty supply and add to it whatever the rains rushing down the mountain sides may bring. In that way small terraces are formed, exactly of the same kind to be seen so often farther north in the Sierra and in the Southwest of the United States, abandoned ages and ages ago.

The greatest number of inhabited caves is found in the western part of the Sierra, toward Sinaloa. It is seldom indeed that the caves are improved. I have, in a few cases, seen partitions of stone and adobe in them, but they never reach the top of the cave. The most common improvement is a loose stone wall in front of the cave, as high as a man's breast, as a shelter against the wind. The caves are rarely found in inaccessible places, like some in the United States; if they are difficult of access, they are made accessible by one or two wooden ladders, or rather notched trunks of trees. The caves are always found apart, at a distance of from one hundred yards to a mile or more.

I heard of one arroyo where six can be seen at the same time, only from thirty to fifty yards apart, but this is a rare case. It is also rare to find more than one family living in the same cave; if so, the people are always near relatives. When the caves are permanently inhabited they are fitted up, as are their houses, with the same utensils, the grinding stones, baskets, and jars. The fire is in the middle of the cave, and the floor is often cemented with adobe. I once saw a species of parapet built of stone gravel, terraced, on a level with the floor of the cave, so as to extend the cave's area. The storehouses, so necessary to the household life of the Tarahumaris for storing corn and clothing, are never missing in the caves. They are built of stone and adobe along the inner walls, and serve as big closets. The largest inhabited cave I have seen was nearly one hundred feet in width and from twenty to forty feet in depth. If the caves are very deep, the Indian lives near the mouth. Never do they excavate caves or holes for habitation.

Although the Tarahumari is not nomadic, his life is shifting. He removes his domestic animals according to season, and plants corn in different localities, moving accordingly. On the highlands the Tarahumari is certainly more permanent, and here the best wooden houses are found. Here they may even be found living in ranches of from five to six families. One ranch had twenty-five families, but even here on the highlands a Tarahumari never lives all his life in the same house; if any one dies, the house is pulled down and removed. Sometimes the Tarahumari moves his house away because the site is a good one for planting corn, the earth having been enriched by habitation. A man who had built quite a good house left it, because he found that the sun did not shine sufficiently upon it. There may be also other reasons, known only to themselves, for moving, because in some parts families have been known to move their habitations ten times a year. A peculiar custom among the Tarahumaris is that at night the father and mother will leave the house or cave to be taken care of by the children, while they go to sleep under a tree, in the shelter of the storehouse, or in some other cave, according to convenience.

Are these cave dwellers related to the ancient cliff dwellers of the southwestern part of the United States and northern Mexico? Decidedly not. Their very aversion to living more than one family in a cave and their lack of sociability marks a strong contrast with the ancient cliff dwellers, who were by nature gregarious. The fact that people live in caves is in itself extremely interesting, but this alone does not prove any connection between them and the ancient cliff dwellers. Although the Tarahumari is very intelligent, he is back ward in the arts and industries. His pottery is exceedingly crude, as compared with the work found in the old cliff dwellings, and its decoration is infantile as contrasted with the cliff dwellers' work. The cliff dwellers brought the art of decoration to a comparatively high state, as shown in the relics found in their dwellings. But the cave dweller of to-day shows no suggestion of such skill. Moreover, he is utterly devoid of the architectural gift, which resulted in the remarkable rock structures of the early cliff dwellers. These people, so far as concerns their cave-dwelling habits, cannot be ranked above troglodytes.

How Flower Pots are Made.

BY AMY WIGHTMAN.

Let us watch a potter at his wheel. The apparatus before him is simple, consisting of a bench, let into the top of which is a horizontal wheel revolving by a treadle. At his right is a tank of water, near which are piled lumps of finely ground clay wet to the right consistence. Each weighs a pound and a half.

At his leftis a board holding six pots just from the wheel. Behind him is a framework on which boards are placed as fast as filled, that the pots may dry before baking. They are the nine inch hanging pots, and the making of one includes nearly all the processes in use for making any kind of flower pot, excepting those made in moulds.

The potter drops a lump of clay on the center of the moving wheel, shaping it with both hands to the form of a short, thick cylinder, which, while turning evenly and rapidly, is hollowed at the top by the fingers and widened slightly, leaving it like a rude cup several inches high. A few downward strokes around the base spread out the allowance of clay for the saucer flat upon the wheel.

Then this whirling cup begins to rise higher and thinner under the potter's fingers, the circle of the rim growing wider and wider, till the cup changes to an old fashioned wine glass, with its flat standard, very short, thick stem, and funnel-shaped upper part. But this form alters as, with wet fingers and sometimes with a wet wooden scraper, the potter presses against the inner side, till, rising higher and swelling outward, its gains a beautifully rounded outline and is the desired size. The edge is turned over at right angles and wetted and smoothed with the scraper till a perfect rim an inch or more wide is formed. Then for the first time the wheel is still, while the drainage hole just above the saucer is punched with a pointed stick from the outside, thus leaving the outer surface smooth, though the inner is rough.

In the same way the holes for chains in the rim of the pot are made, the wheel revolving slowly while the distance between them is measured accurately and quickly by the eye.

Next the rim of the saucer is turned upward and smoothed like the upper rim.

The pot is now ready for the finishing touch, and turns very slowly as the rim is crimped with thumb and finger, the number of scallops coming out even at the end with no gap between or any too near together.

With a quick motion, a wet string held taut cuts the bottom of the saucer from the wheel, and the finished pot is lifted to the board.

The whole process has taken only one minute and twelve seconds. Truly the work seems done as by magic. It is as fascinating to watch as glass blowing, being, not an exhibition of strength or of mechanical precision, but of pure skill in handiwork.

Most of the flower pots now made are shaped in plaster of Paris moulds. These are in three sections, shaped inside like the bottom and sides of a pot, are very thick, and are held together by means of corresponding projections and depressions in their edges. Often the inner surface has a fancy pattern, which, being depressed in the mould, appears raised on the pot. Rustic pots are made in this way. A favorite design is a vine around the rim, the rest of the surface showing a *repoussé* effect.

The process of moulding is short and comparatively easy. There is the same horizontal wheel, though turned by machinery. The mould, holding the right quantity of clay, is placed firmly upon the wheel. While in rapid motion the operator presses against the inside a thin wooden piece suspended from above, shaped like a half section of the inside of the pot. Held firmly against the whirling mould, it forces the clay into the desired shape in a few seconds.

After the porous mould has absorbed the moisture, the pot is taken out and whirled rapidly, while a cutting metal edge is held against it, trimming the ragged edge of the rim and throwing it off in a thin clay ribbon.

The parts of the mould not fitting perfectly, the clay forced into the cracks has to be cut away, after which the pot is ready for baking.

Pieces to be glazed on the inside have a thin brown glazing mixture poured into them, shaken, and turned out. When baked, they are ready for decoration.

The pots to be colored are dipped in a large pail of paint, and turned to drain upon a rack over a shallow box which slants toward and drains into another pail, which, when full, is emptied into the first, thus applying the paint evenly and quickly and with little waste. The inner edges are painted by hand before the ware is baked.

Around the great circular furnaces are built the thick parallel walls of the kilns, reaching to the ceiling; and in this space, perhaps three or four feet wide, the pottery to be burnt is carefully piled, the thick doors shut, the heat gradually raised to the right point and as slowly cooled.

Large flower pots are piled one on another, every other pot being inverted, giving the effect of rows of fantastic pillars. Shelves built of blocks of fire brick support other kinds of pottery. Saucers are set on their rims in horizontal rows.

The unpainted clay wares require for their first baking a heat of 2,500°, and the decorated wares a heat of 2,000°. The degree of heat is estimated by experimenting with substances which are known to melt at certain temperatures.

Around these furnaces, glowing with white heat, the wares are kept twenty-four hours for a first baking, and from four to six hours for subsequent firing as required after decoration.

The red color of baked clay is due to the presence in the clay of oxide of iron.—*The Outlook.*

Transparent Bricks for Hothouses.

Experiments with glass building bricks were begun in 1891, by M. Falconier, an architect of Lyons. These bricks are hollow, being blown like bottles, and are given forms—such as cubes, hexagons, etc.—that permit of ready laying. A bituminous cement, with a base of asphalt, is used with them. The bricks serve as double windows, giving protection against both cold and heat; they are good insulators of humidity and noise, and they lend themselves readily to the decoration of buildings, either by their form or color. Many applications are foreseen. The bricks are neater than marble in meat markets, and especially adapted for bath halls, hothouses, hospitals, refrigerating establishments, and buildings in which absence of windows would be an advantage. A hothouse of glass bricks is of about ordinary cost, saves fuel, and resists hail. *Ashton, England, Reporter.*

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THE EAST RIVER TUNNEL OF THE EAST RIVER GAS COMPANY.

After two years of the most arduous work, including the solution of some of the most difficult of engineering operations, the tunnel between Long Island City and New York of the East River Gas Company, a tunnel constructed for the purpose of providing a conduit for gas pipes from Long Island City to New York, has been completed. We have before this illustrated the progress of operations; to-day, when the tunnel is completed, some further description of the work will be acceptable.

In April, 1892, the East River Gas Company, of Long Island City, N. Y., received its franchise. The company owns a large quantity of land in Long Island City on which it proposes eventually to construct immense gas works to supply the city of New York, and to send the gas through large transit mains beneath the East River. The tunnel penetrates the two channels of the East River and Blackwell's Island, all of which here intervene between its terminal points. It is 2,516 feet long, and the grade is given a uniform slope, the bottom descending about 12 feet toward the Long Island City end, where there is a sump for collecting the drainage. The western shaft is 135 feet deep, the eastern 147, measured from the street levels. Referred to low water mark, the maximum depth of the floor is 125 feet, which gives a minimum of 41 feet of rock and earth above the tunnel. It was originally hoped that it would be possible to excavate the tunnel in solid rock, without the use of compressed air or any special methods, but four or five hundred feet from the New York end of the tunnel a most vexatious kind of clay, or decomposed feldspar, was encountered. The contractor wished to abandon the work as far as executed, but Mr. C. E. Jacobs, the engineer in charge, undertook by his own exertions to penetrate the soft material. The contractors desired to start anew from the shore, and sinking the shaft lower, to begin the tunnel at a level 50 feet or more below the original tunnel. This, if carried out, might have obviated the difficulty; but if the same soft material had been encountered, the new tunnel would have been absolutely worthless, as the great depth would have precluded the possibility of using compressed air.

Soft ground was also encountered on the Long Island side of the tunnel, so that eventually two air locks were established and the work was prosecuted under compressed air with the Beach hydraulic shield, which has been described in these columns in connection with the North River tunnel and the St. Clair tunnel. A very heavy air pressure had to be used, which rose at one time to 52 pounds, the waste of air being very great, as quantities escaped through the roof of the tunnel, causing great ebullition on the surface of the river above. To determine what lay in advance, horizontal drills were operated through the shield, a distance of 67 feet being penetrated in one case. As the shield advanced, a lining for the tunnel, consisting of flanged cast iron plates, was bolted in place, it having been found that brick were not altogether satisfactory in this ground. The very high pressure of air made the work exceedingly dangerous, and the courage shown by the men in entering the air lock under the conditions and in face of the known danger incurred was not short of that shown by a soldier in battle.

The air lock bulkhead was pierced by a number of pipes for different purposes. Electric light and telephone service extended through to the heading; through one pipe the air for the operation of pumps was received; and an exhaust pipe was also carried through the bulkhead so as to provide a connection for the exhaust of the compressed air pumps. This connection was sometimes used when a great many pumps were working, as it of course reduced the pressure by the amount existing in the space forward of the air lock.

The tunnel as completed is of two different sections. Roughly speaking, in hard rock it is 8 feet 6 inches in height and 10 feet in width, the roof having a general curvature of 7 feet radius. This is the minimum template, but of course, as the walls are rough, the tunnel is really larger than this section, and its walls are very irregular. The floors are to be concreted to a true surface. In soft ground it is of circular section, lined with the iron plates already described, which form a cylinder with external diameter of 10 feet 10 inches, having an internal diameter 10 feet clear of all the flanges.

The tunnel is entered by two vertical shafts, one at each end, each shaft being 9 feet square. One of our illustrations shows the general section of the completed work. The entrance to the tunnel near the gas works is shown in another illustration; a simple aperture leading down into the earth represents the beginning of a work of such importance, difficulty and danger. The rough contour of the completed work in rock has been alluded to. In one of the illustrations we show the completed tunnel in solid rock, lighted by incandescent lamps, and illustrating its irregular section. Another cut shows the progress of the work in soft ground with the Beach shield in the background.

On the evening of Wednesday, July 11, at 7:25 P. M., the first drill penetrated the walls separating the two tunnels, this marking the complete penetration of the river. The diaphragm of rock was drilled on both sides and was charged with a number of dynamite cartridges. They were all connected by wire, the wires from one side being led through the single drill hole, so that both sides were connected in the same circuit. Mr. Charles M. Jacobs, the chief engineer, personally exploded the last blast at 11:50 at night, and immediately he and his assistant, Mr. W. J. Ames, side by side, crept through the opening, and went through the tunnel, being the first human beings to go under the East River channel. As they emerged at the Ravenswood end they were enthusiastically received by the workmen. The biggest day's work done at any one heading was executed at the end of the week June 27, when for the entire week 101 feet were penetrated, an average per day of nearly 15 feet. Two years less one day were occupied in the completion of the tunnel.

The air locks set in Portland cement concrete had to be removed. This was done by blasting. A number of shots were placed in holes drilled in the cement and the work was blown away. This operation is the subject of one of our cuts.

The work was in charge of Mr. Charles E. Jacobs, Mem. Inst. C. E., Mem. Inst. M. E., with Mr. J. Bipond Davis as chief assistant.

The tunnel was constructed in two sections, one advancing from the New York end, the other from the Long Island end. The accuracy of the alignment of the two sections was such that when they met a deviation of only one-half inch existed. This was done on base lines of but eight feet length.

Highly Sensitive Collodion Emulsion.

Dr. David, of Paris, has succeeded in preparing a bromide of silver collodion emulsion, the sensitiveness of which increases gradually to 22 or 23 degrees Warnerke.

The method adopted is as follows: Upon a horizontally adjusted glass plate, size 18 by 24 cm., are poured 25 c. c. of collodion, which contains per liter 18 grammes of silver nitrate and 7 to 8 grammes of pyroxyline. After the film has coagulated sufficiently, it is changed to a bromide of silver film by treatment with the following bath:

Potassium bromide	80 to 120	grammes.
Potassium iodide	0·01	"
Gelatine	2	"
Distilled water	1,000	c. c.

A completely opaque film must be obtained. It is sensitized by leaving the plate for a longer or shorter time in the following:

Potassium bromide	18 to 25	grammes.
Gelatine	1	"
Distilled water	1,000	c. c.

The sensitiveness increases with the duration of action and the temperature of this bath. At a temperature of 70 to 75 degrees Cent., the time of action must be about two hours; at 90 to 95 degrees. about one hour.

Upon looking through the film, it will be observed that the grain becomes gradually larger until the granularity is distinctly visible to the eye. Accompanying this increase in the size of the grain is an increase in the sensitiveness of the film.

After the plate has reached the desired stage, it is washed and dried. Contrary to what might be expected, the collodion film does not exhibit the slightest tendency to leave the plate at a temperature of 100 degrees Cent., provided that the surface of the plate has been thoroughly cleansed.

Plates prepared in this way can be developed very quickly, washed and fixed. The negative is ready for printing in ten minutes. Varnishing is unnecessary, as the collodion film is very hard.—*Photographisches Archiv.*

Microbes in Bread.

According to the British *Medical Journal*, Dr. Troitzki, writing in the Russian medical periodical *Vratch*, states, according to *Nature*, that he has found that new and uncut bread contains no micro-organisms, as the heat necessary to bake the bread is sufficient to kill them all. As soon, however, as the bread is cut and is allowed to lie about uncovered, not only harmless but also pathogenic microbes find in it an excellent nutrient medium. White or wheatmeal bread is a better medium than black or rye bread, as the latter contains a greater percentage of acidity. Dr. Troitzki's experiments with pathogenic bacteria gave the following results: *Streptococcus pyogenes aureus* retains its vitality on the crumb of wheatmeal bread for twenty-eight to thirty-one days, on the crust for twenty to twenty-three days; the bacillus of anthrax (without spores) remains alive on the crumb for thirty to thirty-seven days, and on the crust for thirty-one to thirty-three days; the typhoid bacillus remains active twenty-five to thirty days on the crumb, and twenty-six to twenty-eight on the crust; while the bacillus of cholera lives twenty-three to twenty-five or twenty-seven days on both.

Collogravure.

BY HECTOR KRAUS.

Under this name, M. Balagny, of Paris, a Frenchman, has invented and published a novel process of producing collographic prints in fatty inks, which is claimed to be very simple and easy to execute, while no special apparatus of any kind is necessary to work it.

He makes use of a special flexible film of his own invention, which is manufactured for him by the house of Lumieres Bros., in Lyons. These films are made on a paper or similar flexible support, which is coated with the regular bromide of silver gelatine emulsion like any dry plate, but has received a previous special preparation or coating of his own invention for the purpose of making the sensitive gelatine film very strongly adhere to its support. Without this precaution the gelatine film would have a tendency to separate and peel off under the action of the roller when the finished plate is ready to be inked. The writer has experimented and tried this new process with good success by using the enamel bromide paper made by the Buffalo Argentic Paper Company. This paper would be excellently adapted to it, but unfortunately the adherence of the film to the paper did not prove to be sufficient, and it came off under the roller.

What is especially characteristic of this ingenious process is the rapidity of all its operations. It is possible to obtain a print by this method in thirty minutes.

The following contains the mode of operation: The paper or films are cut to the desired size, and are immersed one by one into the following bath:

Water	100 parts.
Bichromate of potassium	3 "

They are left in this bath to absorb all the liquid they are susceptible to, which takes from five to ten minutes, according to temperature. The sheets are then removed from the bath one by one, and placed film side down on a plate of thick glass. With a rubber or squeegee the excess of the liquid is now thoroughly squeezed out, and the back mopped off with a soft rag or sponge. In this condition they are left on the glass during three to five minutes; they are then removed from the glass and carried to the dark room, or put in a box where they are allowed to dry in complete darkness. In this condition the films keep well from six to eight days, but they must be carefully guarded and kept from actinic or day light.

For printing, the ordinary printing frames are used. The negative should be covered with a mask of black or opaque paper to protect the margin of the film about a quarter of an inch all round from the action of the light, the same as in carbon printing. The presence of bromide of silver accelerates the printing considerably and makes the time of exposure a very short one. After all the details are visible, or, in case of transparent films, when the deep shadows are plainly visible on the back, the film is removed from the frame, placed face down against a piece of black cloth or felt, and exposed from the back from thirty seconds to one minute, but never in sunlight. The films are now washed out in frequent changes of cold water until all the bichromate is thoroughly eliminated. They may remain in the water until the next morning. They can also be printed directly after only five minutes' washing, but then the resulting pictures are not so fine and deep. The films are finally fixed in: water, 100 parts; cyanide of potassium, 5 parts; and rinsed again for ten minutes. Before printing they must be mounted on zinc plates. These should be polished and well cleaned. The surface is then poured over with spirits of turpentine, and wiped off with a special rag. The grease left by the turpentine is then removed by passing over the surface of the zinc a sponge imbibed with water 10 parts, silica of soda 3 parts, and rinsed under the tap, but without touching the surface. A piece of gelatine film, such as is sold in sheets ready made, is dipped in water, placed on the zinc and pressed in contact with a roller. The printed film is then taken out of the water and placed on top of the plain gelatine film and also squeegeed in contact with the roller, carefully avoiding foreign bodies and air bubbles. We have then a combination of three surfaces: zinc, a sheet of plain gelatine, and the film carrying the image, entirely connected and kept together by atmospheric pressure. The adherence is perfect. The mounting can also be accomplished in the following manner: by simply squeegeeing the film to a piece of gelatinized parchment paper, such as is used with the apparatus called the photoautocopyist and fastening the whole on the special stretching frame connected with this apparatus.

The surplus moisture is next carefully removed with a soft rag and then flowed over with a twenty per cent solution of glycerine in water, which is left to penetrate the film well, and then removed with a sponge. The remaining moisture is again blotted off with a rag, and the plate is ready for inking. This has been described so often that it will be unnecessary to repeat it. The prints can be made in any kind of a press, even in a letter copying press, but in this to obtain a uniform pressure a sheet of thick rubber must be placed on top of the paper which receives the print.—*Photo. News.*

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TRIAL TRIP OF THE NEW WAR SHIP MINNEAPOLIS.

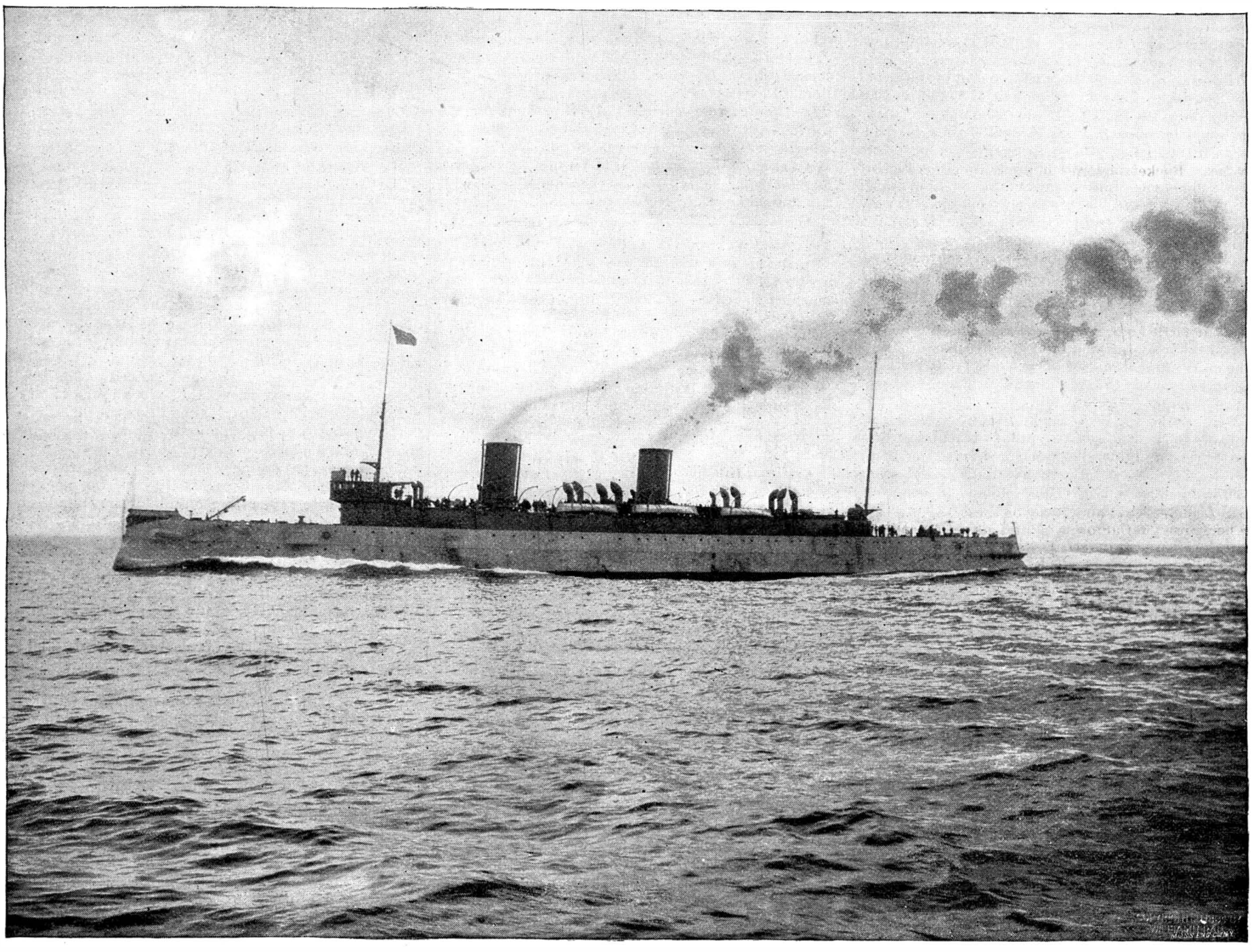
We publish to-day an illustration of the new war ship Minneapolis, taken on the open ocean while running at her highest speed on her recent trial trip. The course was laid out from Cape Ann, Mass., to Cape Porpoise, Maine, and was marked by eight government vessels anchored along it. On July 14 the record was made. Everything was favorable to the trial, the weather being calm for the greater part of the time. When within two or three miles of the starting point forced draught was put on and she entered the course at the rate of 23 knots. With her speed varying from 21 to over 24 knots, the first half of the course was completed. The ship then executed a long turn, computed at some twelve miles in length, and at high speed entered the other end of the course for the second run. The early portion of this run was made at the rate of 25·2 knots, and when the entire distance of nearly 88 marine miles was completed, the average speed, as near as could be deduced with the corrections for tide, was 23·073 knots per hour. This is supposed to mark the best speed on record for vessels of her class, and surpassing the Columbia's speed, which at its time was thought very remarkable. Compared with the Columbia, the Minneapolis appears as a superior ship, although supposed to be a sister. Her grate area is one-seventh larger than that of the Columbia, and her coal bunkers hold over 1,000 tons more. Her horse power is 21,000. The average of her engine revolutions over the entire course was 134, varying at different times from 130 to 136 revolutions a minute.

The illustration is a reproduction of a copyrighted photograph taken by the marine photographer, Mr. William H. Rau, of Philadelphia. In itself the photograph is an elegant example of the art, irrespective of the interest of the subject shown.

The trial was witnessed or attended by a number of well known people, congressmen, engineers, naval officers and constructors and other professional men. The ship was commanded by Captain Sergeant, an old time transatlantic captain.

The Minneapolis is 412 feet long, 58 feet beam, with a mean draught of 22 feet 6·5 inches. The hull is of steel with double bottom, with protective deck varying from 2 to 4 inches in thickness. Her armament is to consist of one 8-inch rifle, two 6-inch rapid firing rifles and eight 4-inch rapid firing rifles, besides the secondary battery. She is driven by triple screws. Her contract price was $2,690,000. The official correction for speed gives her 23·073 knots, with a premium of $414,000 for her builders, the Messrs. Cramp, of Philadelphia.

The Minneapolis was chiefly designed as a commerce destroyer; yet, in the event of war, it is possible that some very severe fighting will be done by ships of this class.



THE NEW WAR SHIP MINNEAPOLIS.

Copper Mining.

The copper industry of the United States has for the past several years presented the anomaly of a steadily increasing production and falling prices, until at the present time copper is selling at a lower figure than ever before in the history of the industry. The decline has been more precipitate during the past year, due to the general depression in business, which while it has greatly curtailed consumption has no effect in lessening production, until at the present writing large stocks are held by producers and in the hands of warehousemen, exports have fallen off considerably, and manufacturers are fairly well supplied for the summer months by the recent sale of 15,000,000 pounds Lake at 9 cents. Since these sales were made private advices from New York record a still lower figure for Lake copper, viz., 8.80. Arizona copper is nominally 8 cents, but there is scarcely any demand for this class of copper.

Up to the present time, says the *Silver Belt*, producers have been enabled to meet the shrinkage of values by improved processes of smelting and refining and economies carried into almost every branch of the industry, but the limit in this direction has about been reached, and there are now very few mines in the United States which can operate at a profit and some that are running at a loss. The present prices, if continued for any length of time, must result in the closing down of important mines and a consequent curtailing of production. Companies cannot continue to run at a loss or exhaust their mines, for in time they will be worked out and costly plants will then become practically valueless. Some of the Michigan and Montana mines are best able to withstand the present depression. The Calumet & Hecla is still the most valuable copper mine in the world, competent engineers estimating that the company can lay copper down in New York at 6 cents per pound, and that the vast ore bodies in the mine are sufficient to last for fifty years.

It is doubtful if any of the copper mines in Arizona can now be operated without loss, except the Copper Queen, and possibly the United Verde, and the small margin of profit remaining to them makes continued production a matter of questionable expediency. Of course no one expects the present low price of copper to prevail longer than a few months, and should the business of the country revive perceptibly, the price of copper would respond to the quickened demand and consumption, and new life would be instilled into the industry.

It is not probable that the price of copper will ever again rule as high as in former years. As before suggested, the efforts of mine owners are concentrated in the direction of more economical and larger production, and while the prevailing depression may give a temporary check to expansion, yet copper will be among the first industries to feel the benefits of returning prosperity. A moderately low price for copper (10 to 11 cents) has the advantage of stimulating consumption, enlarging its field of usefulness, and enabling its substitution for less desirable metals in the manufactures.

Globe, while temporarily handicapped by the excessive cost of transportation, is one of the greatest copper districts in the Southwest. Her ore deposits are rich and extensive and as yet scarcely infringed upon. The process of smelting is the simplest and least expensive, and the copper when it comes from the furnace is so pure as to require no refining and goes into the market as a good merchantable copper. All that is required to give life to copper mining in Globe district is cheaper rates of freight on coke and copper, which seem assured at no distant date by the completion of the Gila Valley, Globe and Northern Railroad.

ONE pound of cork is amply sufficient to support a man of ordinary size in the water.

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Timber Culture in Tennessee.

Tennessee is one of the few States that have not been stripped of their timber without concern for future needs and climatic conditions. About fifty per cent of the land in Tennessee is still wooded. There are 26,880,000 acres in the State altogether, of which nearly 13,000,000 are timbered. Only three States in the South have a greater timber acreage—North Carolina and South Carolina and Georgia. As the altitude of the forests of Tennessee varies from 200 to 6,000 feet above the sea's level, woods of every kind known to the United States are to be found there. In value, the oak has the first place, but the ash, of which there are two varieties, the white and the blue, is hardly less important. Even in Tennessee the forests of ash are now found only in districts remote from the railroads, but so rapid is the growth of this tree that it is being planted as an investment. A farmer who set out a grove of ash trees covering ten acres twelve years ago now has 12,000 trees 8 inches in diameter on an average and 35 feet high. There were no expenses of cultivating, and the ten acres of 12,000 trees are worth at the present time between $7,000 and $8,000. Besides oak and ash, Tennessee possesses three varieties of elm, two of gum, two of fir, three of hickory, two of locust, three of maple, two of pine, three of poplar, and two of walnut. Among other trees found in abundance are the beech, birch, buckeye, red cedar, wild cherry, cottonwood, cypress, dogwood, basswood, mulberry, tupelo, sycamore, and the sassafras. Of oaks, there are no less than twelve varieties. Cedar, unfortunately, is going very fast. Bucket factories in the State use 5,000,000 feet of this timber every year. Telegraph companies use it almost exclusively for poles. Nearly 1,000,000 feet goes each year to St. Louis, where it is made into fence rails. The rapidity with which the cedar is being consumed has opened the eyes of some of the friends of the forests in Tennessee, and a warning has been sounded.—*N. Y. Evening Post.*

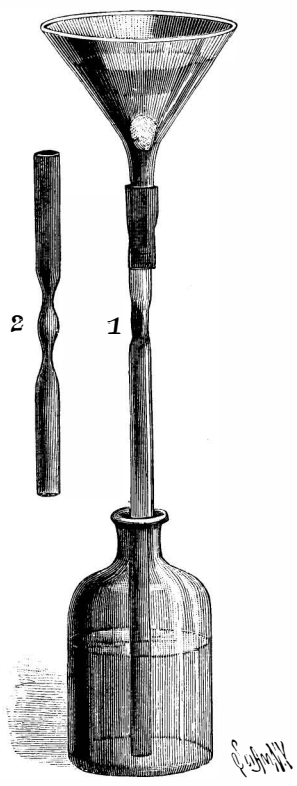
INCREASING USE OF TRACTION ENGINES.

The successful employment of the traction engine in heavy work is most effectively illustrated in the logging business of the Siskiyou Lumber Company, at Sisson, Cal., as shown in our engraving, made direct from a photograph. It is said the grades traveled over are also much steeper than it has been usual, heretofore, to attack with traction engines, but that the work is in every way successfully performed. The engine shown was made by the Best Manufacturing Company, of San Leandro, Cal., and many of these engines are now being used in California for agricultural purposes, freight hauling, etc. As the engine is three-wheeled, it can be turned in as short a space as a two-horse wagon. The starting, steering and reversing of engine, and pumping of water, are all done by one man without leaving his seat. The drive wheel tires are of steel, and the height of the wheels of the 50 horse power engine is 8 feet; the width of the tire, 26 inches. The engine is supplied with a windlass for hauling logs out of canons and other inaccessible places, this also being operated by the engineer from his place on the engine.

One of these engines is reported to be employed in hauling freight between Farmington and Stockton, Cal., on a road parallel with the railway and at the same rates, its owner thus doing a large and profitable business. The saving effected by their use in all kinds of agricultural work is something remarkable, the figures given for plowing, harrowing, and seeding, with the aid of these engines, being as low as 60 cents per acre, while, with the aid of a steam harvester, it is said that grain may be cut, thrashed, recleaned, and sacked ready for the mill at a cost of but 30 cents per acre.

RAPID FILTERING APPARATUS.

Mr. George A. James, chemist, of Selby, Cal., has sent us sketches of a very simple and effective filtering apparatus which we thought our readers would be interested in seeing. A glass tube of any convenient length, having a contraction near its upper end, is connected with the small end of the funnel by a short piece of rubber tube. The lower end of the glass tube is inserted in the bottle or other vessel which receives the filtered liquid, and the funnel is supported by a filter stand (not shown).



RAPID FILTERING APPARATUS.

The contraction in this case is made by flattening the tube so that its sides approach each other to within a very short distance, say $\frac{1}{100}$ of an inch. This contraction prevents air from entering the part of the tube below the contraction, and thus maintains a solid column of liquid below the contraction. The liquid by its weight produces a partial vacuum in the tube, and thus allows the air pressure on the liquid in the funnel to force the liquid through the filtering medium. The rapidity with which the filtering is accomplished depends upon the length of the tube, other things being equal.

In Fig. 2 is shown a modification of the apparatus, in which the tube is contracted evenly all around in two places, leaving a small circular opening instead of a flat one.

Experience shows the flattened tube to be preferable.

A Poser for Papa.

"Papa," said little Katie, "do you know how high those clouds are?"

"No, child," answered her father, with an indulgent smile.

"Well," said Katie, regarding them with critical eye, "I do. They're cirrus clouds, and they're about three miles and a half high. You didn't have very good schools when you was little, did you, papa?"—*Chicago Tribune.*

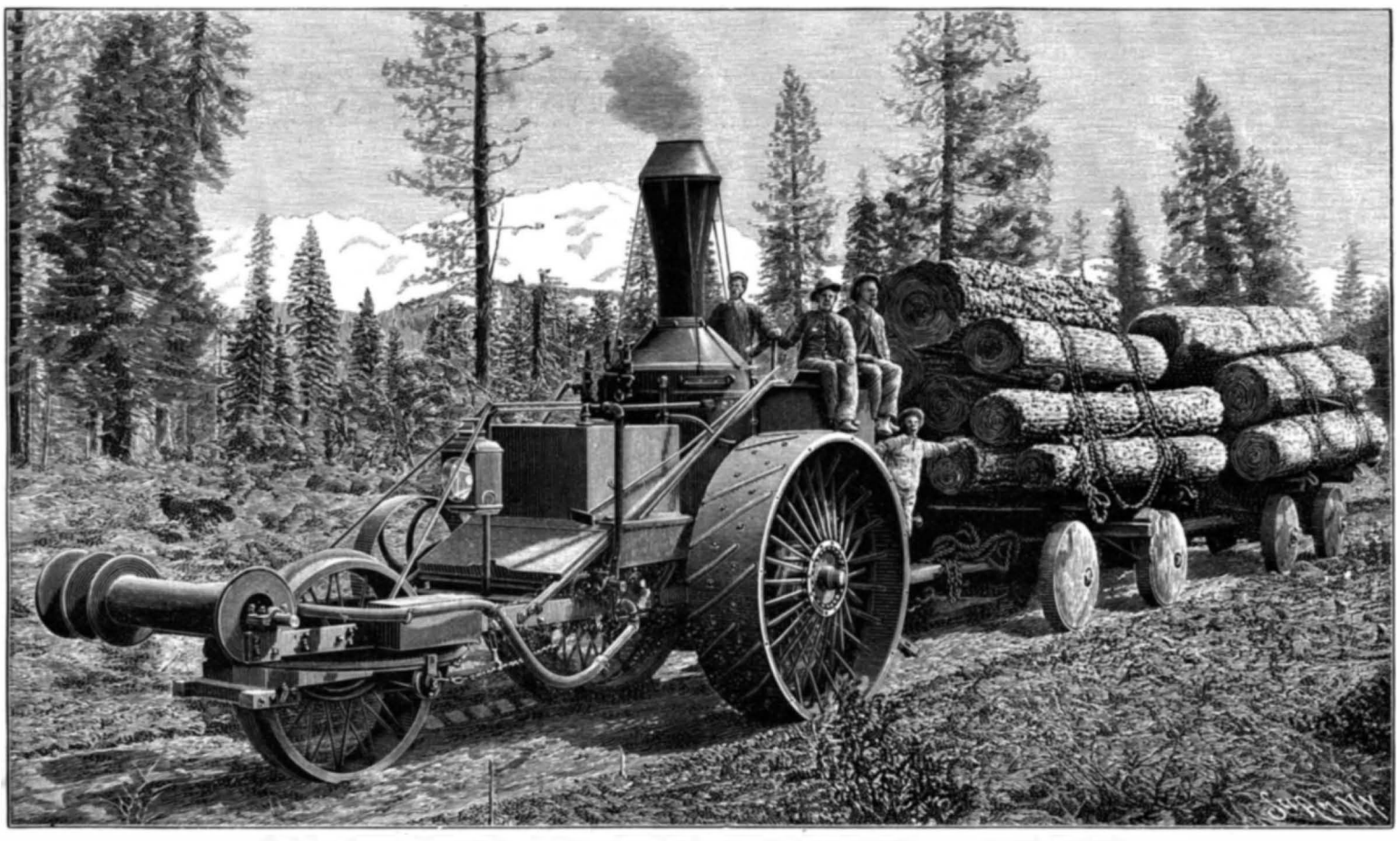
Remarkable Armor Plate Trial.

The St. Petersburg correspondent of the London *Times* says a remarkable trial of English armor plates took place on Thursday, June 28, in the artillery polygon at Okhta, near St. Petersburg, with results that were certainly startling. There were three plates—one from Messrs. Cammell, measuring 8 feet square and 6 inches in thickness, and two from Messrs. John Brown & Company, one being of the same dimensions as those of the Cammell plate, and the other 8 feet square, 10 inches thick, and bent. All three plates had been face-hardened by the Harvey process. The gun used throughout was a 6 inch Oboukhoff of 45 calibers. The projectiles were of two sorts—namely, the latest improved Holtzer shell, made at the Russian Putilof works, and a similar shell with a Russian improvement, the secret of which is jealously guarded. The velocity of six rounds fired at the 6 inch plates was about 1,850 foot seconds. At the 10 inch plates the velocity was nearly 2,400 foot seconds. One round was fired with each projectile, which, on account of the curvature of the plate, struck with an obliquity of from eight to ten degrees. All the shells treated by the secret Russian process penetrated the targets entirely, and sped some thousand yards to the rear, while the other shells under similar conditions, though obtaining greater penetration than has ever yet been reached by any projectiles known in England, were stopped and broken up. The secretly improved shells passed right through a wooden screen erected a short distance from the backing of the plates, so that there could be no doubt that they went through the plates undamaged, although no one was allowed to see them afterward.

It would seem that two lessons are to be learned from this important trial. In the first place the Holtzer shell made in Russia is better than any known in England; and secondly, the secret Russian improvement which it has always been expected would fail when tested by oblique firing has undoubtedly proved itself to be a remarkable success, and has placed in the hands of the Russian government a projectile superior to any hitherto invented. The oblique tests in themselves will be immensely useful, as I understand that very little experience has up to the present been gathered by oblique firing against armor. This in real warfare would naturally be the rule, and not the exception. Further trials at still greater angles of obliquity will take place.

Utilization of the Earth's Heat.

In his address to the *Chambre Syndicale des Produits Chimiques*, Mr. Berthelon, the illustrious chemist, suggested as a subject for the attention of the next generation of engineers the substitution of the heat of the sun, or the central heat, as a source of energy, for that derived from coal. The sinking of a shaft three or four kilometers deep is not beyond the power of modern and especially of future engineering. At such a depth, water would be found with a temperature of 160 degrees to 200 degrees Cen., which would develop enough power for any number of machines. This power would be available in any part of the globe, and many thousands of years would pass away before this store of energy would suffer an appreciable diminution.



TRACTION ENGINE USED FOR LOGGING PURPOSES IN CALIFORNIA.

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The Storage Battery of the Air.

BY PROF. ALEXANDER M'ADIE IN "HARPER'S MAGAZINE."

The air will stand a strain of about 9,600 grains per square foot before breaking. That is, the flash will occur when the electrical pull amounts to this, 1·37 pounds per square foot. For the energy of a cubic mile of strained air just before the flash we have, then, about 70,000,000 foot tons. The average thunder head or cumulo-nimbus cloud is not a mile high, however. For a small cloud, one a hundred yards square, and distant only a quarter of a mile, we would get about 300 horse power. Now a flash even a quarter of a mile long means a potential of many million volts. We cannot at present measure this directly, but we can determine the potential of the air within certain limits on any day, thunderstorm or no thunderstorm. In 1885, at Blue Hill Observatory, and in subsequent years, we measured the potential of the air with insulated water-dropping collectors, after the methods of Thomson (now Kelvin) and Mascart. The top of the hill is 600 feet above the surrounding country; but with Franklin's idea of reaching out a little farther from the earth, I ventured to use at times a large kite, tin-foiled, and for kite string some 500 feet of hemp fish line wrapped about with fine uncovered copper wire. During thunderstorms the sparkling and sizzling at the electrometer end of the kite string were incessant and startling. And even on cloudless days I found it possible to draw sparks, reading at the same time on the electrometer from minute to minute the electrification of the air in volts. In 1886 and 1887, in some investigations carried on by the Chief Signal Officer, and more immediately under the supervision of Professor Mendenhall, I experimented at the top of the Washington Monument, at that time the highest edifice in the world. The investigation continued many months, but perhaps days on which severe thunderstorms occurred were most impressive.

It being beyond dispute, then, that high potentials can be obtained from the air, the question naturally ensuing is, Can we not use them? With three or four sparks as small as those mentioned above, a large fruit jar can be cleared of smoke with which it has previously been filled. Perhaps nature repeats this on a large scale with lightning and clarifies a foul dust-laden atmosphere with these great sparks. It may be, too, that these flashes are all needed, and to attempt to divert them would be unwise. Be that as it may, we are living in an age of "step-up" and "step-down" transformers; an age when, for the first time in centuries, we are perilously near duplicating lightning. Until recently we studied lightning only in miniature. Prof. Elihu Thomson was kind enough to show me in his Lynn laboratory, two summers ago, some of his larger home-made lightning. Indeed, potentials of 100,000 volts are less rare to-day than potentials of 5,000 volts were five years ago. All who saw the Thomson and Tesla exhibits at the Electrical building, Chicago, will easily believe that it is within our power to turn the fleeting high-potential lightning into a current of lower potential and use it.

Professor Trowbridge, of Harvard University, in a discussion of some photographic negatives, shows that "the discharge follows exactly the same path in air for three hundred thousandths of a second," and adds that "it is probable that an ordinary discharge of lightning of a few hundred feet in length could light for an instant many thousand incandescent lamps if it were properly transformed by means of a step-down transformer." The eye alone cannot give a complete history of the myriad minor flashes during a thunderstorm. The charred, though to us intensely brilliant, crack in the air which we call lightning is but a great splash in the ether ocean. The waves and ripples come tumbling along in all directions, spreading rapidly, aye, very rapidly, nearly 200,000 miles per second. Given a proper resonator, and the waves will do work. If my reader keep every sense on the alert, he may happen on some strange illustration of work done by lightning, now all unsuspected. In the tinkling of the telephone bell, the blinking of an incandescent lamp, the melting of a fuse, or the tiny spark from a gas pipe or loose wire, is the constant proof that there are more things going on between heaven and earth during a thunderstorm than most of us dream of in our philosophy.

Old Tin Cans.

Getting a "corner" on old tin cans and scrap iron will strike many as being an odd undertaking, yet this is what a Butte, Mont., alderman has done, says the *Inter-Mountain* of that city. Within the past six months business of saving the copper that flows in solution in the waste water from the mines has grown to be quite an industry, and Mr. Ledford, who has a lease on the Anaconda mine water, is carrying on the business on a large scale. He requires a large quantity of tin cans and old iron. Heretofore these could be had for the hauling away, but they have been so much in demand that the owners have set a price on them, and men are regularly engaged in their collection. The alderman alluded to is said to now control all the available old iron and tin cans in Silver Bow County, and has several car loads stored away which he will be willing to sell. It is understood he is desirous of getting into the copper business himself, and as he now thinks he holds the key to the situation it is likely that somebody will be forced to come to his terms or take him in as a partner.

The Spontaneous Ignition of Lamp Shades.

Dr. A. Dupre has described, in a letter to the *Times*, a remarkable instance of the spontaneous combustion of a paper lamp shade. It is stated that the shade in question was made about a year ago in the familiar style, of two sheets of crinkled tissue paper—one white and one yellow—gathered together at the top, and fixed to the wire frame, forming a considerable bunch of the material. For two days prior to the accident the lamp had not been lighted; and there had been no fire in the room. After the morning of the day of the fire, when the room was dusted and the shade seen to be apparently in its usual condition, the apartment had not been entered; and when the charred remains of the shade were at length found, the indications were such as to leave no doubt in Dr. Dupre's mind that the case was one of genuine spontaneous ignition. The cause is ascribed to the presence of chromate of lead in the yellow paper. The dangerous quality of such papers is readily detected by setting fire to it, and blowing out the flame. In the case of ordinary paper, it will be found that the glow along the burnt edge is very soon extinguished, while the presence of chromate of lead in paper causes it to act like touch paper. Besides the yellow paper, pale green tissue papers are also colored with the chromate, and would, doubtless, be equally dangerous; and there may be others in the same condition. The extensive use of the prettily colored crinkled papers for home-made lamp shades, etc., lends importance to Dr. Dupre's discovery. He admits that he has not yet been able to reproduce experimentally the necessary conditions leading to the spontaneous ignition described; but possibly the long drying that a year-old lamp shade receives had something to do with it.

Suspended Animation.

Ordinarily, if oxygen, water, nourishment, or heat be removed, death ensues. Experiments, however, have shown cases of suspended animation, in which the absence of one or more of these essentials to life has not produced death. Spallanzani experimented with a great many microscopic forms of life, and attained some interesting results. Some of them he dried eleven times, expecting to see them killed, but they revived every time. Doyere did the same, then heated them to 150 degrees Fah., and placed them in a vacuum for four weeks, but they revived when he poured water upon them. Baker kept them dry for four years, and then revived them by water. Lately, however, it has been proved that the forms which revive are not identical with those which were dried up. The animalcules themselves died, but their eggs withstood the severe heating of 150 degrees. In boiling water they would have perished.

Spallanzani has proved that the common snail may be deprived of any of the four conditions of life and yet survive. It simply retires within its shell and goes to sleep. Spallanzani cut small openings in the shells of the snails. Through these he could clearly see the functions of life in operation. As the temperature gradually diminished, these operations became weaker and weaker; at 0 degree all movements ceased, and the snail appeared to be dead. As soon as the temperature was raised, movements indicative of life began again; by raising the temperature to normal height, the snail regained its normal powers. Thus the experimenter quickened and reduced life at his pleasure. To prove that the absence of heat suspends the snail's animation through the winter season, Spallanzani made the following experiments. When the snail retired within its shell, it closed it hermetically, and both shell and operculum were impenetrable to air. The scientist bored a very small hole in the operculum and fastened a fine glass tube in it, excluding the possibility of air getting in. He then placed the snail under water and forced air into the shell through the tube. If there were any fine openings in the shell or the operculum, or if the snail before entering had filled the shell with air, the air forced into it by means of the tube would cause air bubbles to be visible through the shell; but Spallanzani could not detect any. He made another experiment to test this. He bored a hole in the operculum of another snail, and again fitted an air-tight glass tube into it and filled the tube with quicksilver. He then turned tube and snail upside down and dipped the end of the tube into a cup filled with quicksilver. If the snail's shell was absolutely without air the tube would show it, for it would act like a barometer.

Spallanzani found that there was no air inside of the shell. During the winter he placed several "snail-barometers" side by side with ordinary barometers for comparison. The "snail-barometers" acted exactly as the regular barometers. Spallanzani, however, went further. It was possible, he thought, that the snail, before shutting himself up, might have laid in a supply of air. He therefore extended his experiments to many specimens, making examinations just after the snail had retired, in the middle of winter, and in the spring, and proved to his satisfaction that the snail had not breathed during the winter. He also kept a number of snails during the winter on the bottom of glass jars filled with water, oil and quicksilver, proving conclusively that they had no air supply during that time. To prove that it is want of oxygen that puts the snails to sleep, he set them in a vessel filled with hydrogen. For about ten minutes the interior organs acted as usual, breathing the hydrogen; but suddenly they ceased, and the snail closed the sheli by the operculum and lay still. At the end of five hours Spallanzani forced a little atmospheric air into the lungs of the snail, and almost immediately the heart began to act and the blood to circulat. When he stopped the supply of air, the operations of life also stopped. The snail remained immobile when carbonic acid gas or hydrogen was forced in. It is, consequently, the oxygen which sets the organism in motion.—*Naturen og Mennesket* (*Copenhagen*).

A Portrait of Napoleon.

Napoleon was at that time moderately stout. His stoutness was increased later on by the frequent use of baths, which he took to refresh himself after his fatigues. It may be mentioned that he had taken the habit of bathing himself every day at irregular hours, a practice which he considerably modified when it was pointed out by his doctor that the frequent use of hot baths, and the time he spent in them, were weakening, and would predispose to obesity. Napoleon was of mediocre stature (about 5 feet 2 inches), and well built, though the bust was rather long. His head was big and the skull largely developed. His neck was short and his shoulders broad. The size of his chest bespoke a robust constitution, less robust, however, than his mind. His legs were well shaped, his foot was small and well formed. His hand, and he was rather proud of it, was delicate and plump, with tapering fingers. His forehead was high and broad, his eyes gray, penetrating, and wonderfully mobile; his nose was straight and well shaped. His teeth were fairly good, the mouth perfectly modeled, the upper lip slightly drawn down toward the corner of the mouth, and the chin slightly prominent. His skin was smooth and his complexion pale, but of a pallor which denoted a good circulation of the blood. His very fine chestnut hair, which, until the time of the expedition to Egypt, he had worn long, cut square and covering his ears, was clipped short. The hair was thin on the upper part of the head, and left bare his forehead, the seat of such lofty thoughts. The shape of his face and the *ensemble* of his features were remarkably regular. In one word, his head and his bust were in no way inferior in nobility and dignity to the most beautiful bust which antiquity has bequeathed to us.

Of this portrait, which in its principal features underwent little alteration in the last years of his reign, I will add some particulars furnished by my long intimacy with him. When excited by any violent passion, his face assumed an even terrible expression. A sort of rotary movement very visibly produced itself on his forehead and between his eyebrows; his eyes flashed fire; his nostrils dilated, swollen with the inner storm. But these transient movements, whatever their cause may have been, in no way brought disorder to his mind. He seemed to be able to control at will these explosions, which, by the way, as time went on, became less and less frequent. His head remained cool. The blood never went to it, flowing back to the heart. In ordinary life his expression was calm, meditative, and gently grave. When in a good humor, or when anxious to please, his expression was sweet and caressing, and his face was lighted up by a most beautiful smile. Among familiars, his laugh was loud and mocking.—*Memoirs by Baron De Meneval.*

The Color of the Electric Arc Light.

Prof. J. A. Fleming has shown that the well known color of the light of the electric arc from carbon points is due to the incandescence of the carbon filling the space between the positive and the negative rods. The true arc is here, and exists in a space filled with the vapor of carbon, which has a brilliant violet color. Examined by the spectroscope, the central axis of the carbon arc gives a spectrum marked by two bright violet bands. Outside this is an aureole of carbon vapor of yellow or golden color. The electrical strain of the arc occurs chiefly at the surface of the crater which forms at the end of the positive rod, where, in fact, the principal work of generating light is done; for 80 per cent of the total light of the arc comes from the incandescent carbon at this place. Thus, in a sense, the arc light is mainly an incandescent light; the effect being produced by the layer of carbon which is being constantly evaporated at an extremely elevated temperature. Hence the light of the carbon arc is not, and can never be, white, as it is sometimes described as being, but must always be tinted violet by the carbon vapor normally present between the rods.

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EUDYNAMIS NIGER.

The islands of Oceania and Southern Asia harbor a little group of cuckoos (Eudynamis), which are characterized by a thick, strong, hooked beak that is very much curved on the top, while the under jaw is almost straight, strong feet, wings of medium length, and a long rounded tail. The male is usually black and the female is more or less spotted with black and white.

The best known of this species is the Eudynamis niger or Cuculus niger. The male is a brilliant greenish black, the female dark green with white spots on the back, white bands on the wings and tail, and underneath it is white with black spots, which are elongated near the neck and are heart-shaped on the breast. The eye is scarlet, the beak pale green. The length of the male is about 16 inches and of the female about 18 inches. This bird is found all through India and on the Malay peninsula and the Philippine Islands. He lives in gardens and groves, feeding mostly on fruits.

The female seems to deposit its eggs only in the nests of the two species of crow found in India (Corvus splendens and Corvus culminatus). And these eggs are so often found alone that some think that the mother bird destroys the crow's eggs contained in the nest where she wishes to deposit her own, while others maintain that the young cuckoo throws the young crows out of the nest; we have also seen it stated that the mother crow raises the whole brood together, bestowing the same care on the little interloper as on her own young ones.

The natives of India are very fond of these birds and give them various names, which are an imitation of their notes, which please them so well that they often cage the birds, prizing them as other people do fine singers. The European finds their few notes very tiresome. For our engraving we are indebted to Brehm's *Thierleben*.

EUDYNAMIS NIGER—YOUNG MALE. (One-half natural size.)

The Cant That Makes Trouble.

As Senator Hoar told the students of a summer school at Worcester, recently, this country itself "is nothing but a great labor organization," and the Debs strike "is nothing but a little labor union rising against a great one."

The assumption of Debs and his crew that there is in this country a distinct class called Labor, and that they represent it, does violence to every American principle and tradition.

In truth, labor and toil have been the lot of people from the beginning. They are all laborers here, or, at least, the drones are so few that they are not worth counting. The proposed Populistic income tax is made to discriminate against people with incomes exceeding $4,000; and how many are there of them? Only about 85,000 out of 70,000,000 people, according to the estimate of the framers of the vengeful imposition. Of these 85,000, too, how many get their incomes without regular labor on their part? The number is not 8,500. Even the richest of them are oftentimes the hardest workers, and the great mass of them is made up of people who have gathered by toil accumulations which they keep only by constant industry, or of men who are laboring day by day in the professions or in business. Hardly more than one in ten of them has any money which was not made by his own ability and industrious application. In the whole Union there are not more than a hundred large fortunes which were not built up by the personal exertions of the men to whom they now belong. Take the rich railroad men. All of them, two or three familes excepted, began poor. Nearly every superior railroad officer has worked his way up from the bottom of the ladder; and the same possibility of ascent remains for those who are low down. They are all laborers together, from the superintendent down to the switchman, and each is paid according to the value of his services.

It is a disgrace to an American that he is willing to be included in a specific class designated as Labor. Is he not an American citizen? Has he not an equal voice in the government of the republic? Why should he speak of himself as if he belonged to one of the fixed social gradations of an aristocratic system, when he is a member of a society in which all are laborers, and in which the capital is almost wholly held by men who began where he is, poor though he may be?

In this country there are no classes. There is only one class, and all the citizens belong to it. To speak of Labor as a distinct social classification is to outrage the spirit and the principle of our institutions. It is not the sort of talk befitting Americans.—*New York Sun.*

Colorado's Newest Railroad.

Owing to the assured richness of the Cripple Creek gold district, two railroads—one tapping the Denver and Rio Grande, at Florence, and heading north, the other running south from Divide Station, on the Colorado Midland—have been projected and pushed forward with all possible energy during the past few months.

The Florence and Cripple Creek Railroad will open through to Cripple Creek on or about July 1. At the present writing its northern terminal is Victor, one of the principal towns of the Cripple Creek district, and connection is made at that point with six-horse stages running to the famous mining camp. The distance from Florence is a trifle over forty miles, and the ride is one of the prettiest and grandest in all Colorado. It was my privilege during the past week to make the trip, going in by way of Florence and out *via* Divide, and I predict that when these lines are completed, this little circle will become the most popular of all circle trips for tourists in Colorado. A steep climb from Florence takes you to the top of *Mesa* and affords a lovely view. Looking to the south, you see the myriads of oil wells marked by towering trestles, while the whole landscape for miles is dotted with enormous oil tanks, now nearly all under control of the Standard Oil Company, while beyond and to the west extends the most glorious of all ranges of the Rockies, the Sangre de Christo, the snow-topped peaks standing in bold and beautiful contrast with the bright green of the lowlands. Then comes the canon with its interminable windings along the banks of the stream which is crossed and recrossed no less than nineteen times within two miles on truss bridges.

Puffing and snorting, our little narrow-gauge engine with its train of three cars toils and struggles up the grade, and at every turn the scene grows wilder and more beautiful. We are fighting with every revolution of the drivers, right into the very heart of the Rockies now, and with me the sensation of riding over a new piece of road is so novel, I became positively enthusiastic. Out of one canon, we plunge again in another, and at the farther end of this one make a detour of almost a complete circle before commencing the climb up the mountain. In a few minutes four tiers of track are seen below us, and when the summit is reached the scene is one of the finest I have ever looked upon. Dense foliage of the graceful quaking aspen and the sturdy pine covers all the mountains in the foreground, while again the Sangre de Christo forms the horizon to the south and west, its peaks standing in witching silhouette against the bluest and clearest sky in the world. And now we are approaching the richest treasure ground on the continent. Prospect holes are seen on all sides. Blue-shirted miners with laced boots are seen at every hand; then comes in sight Blue Hill, the stronghold of the striking miners during the recent trouble, with its fort-clad peak. Winding and twisting and even climbing we pass close to the Strong mine, with its shaft-house destroyed, and the ground around it blackened by the explosion of an enormous charge of dynamite set off by the unruly element of the strikers, while eleven non-union men were in the drifts below. Fortunately and miraculously all escaped unharmed after two days' imprisonment in the mine. Fine shaft houses are here seen on all sides, for we are now on one of the richest mountains in the district. Passing numbers of log huts and rudely constructed cabins, we come to Victor, the present terminal station, crowded with miners, soldiers, and idle men awaiting the mail and the Denver papers. Cripple Creek is still an hour's run by stage, so mounting to the top of the big "Concord," with its six horses, I watch the scene with intense interest. All is new to many of our passengers, as is evidenced by their excited manner and numerous questions. A motley crew of all sorts, colors and conditions finally crowd into and on top of the stage, and we are off.

The Florence and Cripple Creek Railroad, which we have just left, is $40\frac{5}{10}$ miles in length, has a grade varying from one to almost four per cent, is admirably constructed, and cost on an average $17,000 per mile, not including stations and terminal properties.

Many of its curves are of 30 degrees, but so well laid and accurately raised that none of that disagreeable creaking or "singing," as the flange plays against the curve, is heard. Being a narrow gauge railroad, it was enabled to purchase at a low figure from the Denver and Rio Grande its supply of equipment, unused by the former company since the widening of its gauge to the standard. The future of the camp insures the prosperity of the line, and even at the present time its earnings are most satisfactory.

As we drive from Victor to Cripple Creek the grade of the new road is seen winding along the mountains, and hundreds of men are busy laying the steel and making ready for the early opening.

Down through the gulch plunges our heavily-loaded stage, and through one continued succession of settlements we rush on a gallop, till, at the end of an hour, the arc lights of Cripple are seen. Pulling up at the hotel, another crowd welcomes us, and such a crowd! All quarters of the world, except China, have contributed to the population of this camp. Chinese are barred by local edict, and woe to any ambitious Celestial who seeks his sanitary mission within the confines of Cripple Creek. It may be unconstitutional, but the edict is none the less effective for a trifle like that. The large, gaudy office of the miserably wretched hotel is crowded far into the night with men on all errands, but every man in the outfit can produce at least one piece of rich ore from his corduroy suit with most wonderful details as to the width of that particular vein and the richness of its assays.—*New York Railroad Men.*

Glass Coloring in Germany.

The beautiful coloring of certain varieties of glass now produced in Germany, and which is said to far excel some of the most noted French specimens, is an art practiced by the glassblower at the furnace, by means of an apparatus consisting of a sheet iron cylinder, 20 inches long and 8 inches diameter, standing vertically, and having a similar cylinder riveted across the top. *Kuhlow's German Trade Review* says that in the lower cylinder is an opening into which an iron ladle can pass, and the horizontal cylinder is provided with doors at either end, the one nearest the operator being so arranged that the blowpipes can be supported when the door is closed in a horizontal split running to its middle, the object to be treated being held inside. While the glassblower is reheating his work for the last time in the furnace, an attendant takes the long-handled iron ladle, which has been heated red hot, shakes into it about a spoonful of a specially prepared chemical mixture, and places the bowl of the ladle quickly in the opening provided for it in the vertical cylinder. The mixture immediately gives off vapor, which rises to the horizontal cylinders, where, meanwhile, the blower has placed his work, supported by the blowpipe and heated to an even red, turning it rapidly in the vapor. In a short time the object is covered with a changeable luster, is removed from the pipe, and tempered like other ware in an ordinary oven, then cut, engraved, painted, or gilded as desired.

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[FROM THE MOUNT LOWE ECHO.]

Saturn and His Eclipses.

The story of Saturn would be incomplete were I to omit in its recital to mention the vast number of total eclipses both of the sun and of the satellites themselves, and of the enormously long duration of those of the sun by the rings as seen from various latitudes both north and south of his equator.

The nearest satellite revolves around the planet in 22½ hours, going through all its phases from new moon to full and back from full to new so rapidly that the changes, both in position and phases, would be visible to a Saturnian inhabitant. Seen first in the west as a narrow crescent, it would in five hours grow to a full round face, and would have moved half round the sky or over a space equal to the apparent size of our moon in two minutes. If the months of Saturn be reckoned by this satellite, there would be nearly thirty thousand of them in his year, or two and one-half times as many as our year has hours. But as he has, at least, eight attendant moons, there is opportunity for speculation as to which of these orbs should have the honor of regulating the length of the months.

Let the reader imagine himself on the great globe of Saturn, in, say, north latitude corresponding to that of any place in Southern California; he would behold three vast arches, the inner one nearly transparent, the middle one much the widest and opaque, and, outside of this, a much narrower one, also opaque, all extending east and west from horizon to horizon. In the spaces between these arches he could distinguish the stars, some of the satellites, and, occasionally, the sun. Were he situated in, say, 20 degrees north latitude, at a certain season of the year, he would see the sun rise clear of the ring on the northern side, pass diagonally across them, being partly obscured while behind the crape ring, but shining brightly while in the space between it and the middle bright ring, and, passing behind that, would be totally eclipsed, but emerging, would cross the 1,700 mile interval between it and the exterior bright ring under which it would suffer another total eclipse, but from which it would finally reappear and pass the meridian clear of them all. It the afternoon a like series of eclipses, both total and partial, though in reverse order, will be witnessed, the sun setting, as it rose, clear of the rings. And this arrangement will last with but slight variation, during some part of the day, for 11 years and 306 days. In latitude 40 degrees north, the sun will, at a certain declination, both rise and set totally eclipsed, being seen unobscured only at mid-day, for the space of one year and 28 days. At this same latitude, with the sun's declination such that his apparent daily motion is paralled with the rings, the sun as he climbs higher will, after many partial eclipses, pass behind the ring and a total eclipse, lasting from sunrise to sunset, will be produced. Each day on that planet as on the earth at this season of the year, the sun gradually ascends till his greatest declination north is attained, but always behind the ring. His descent then begins, but thirty times slower than that of our sun after June 21, until finally his lower climb emerges from the ring, when totality ends after having endured all through each day for a term of six years and 236 days or 5,543 Saturnian days. Following this, for a long time, the eclipses will be partial until the sun is clear of the rings.

Astronomers on our planet hail with delight the coming of a total solar eclipse, and hie themselves to the uttermost parts of the earth to observe its varied and interesting phenomena, even though it shall last but the brief space of two minutes, as the occasion is one of great value for the determination of the cause and nature of the sun's corona and many other matters pertaining to its physical nature, but what must their emotions be at the reflection of an eclipse so extended as those we have described? LEWIS SWIFT.

Lowe Observatory, Echo Mountain, June 23, 1894.

The Danger Point of Burning Oils.

A demonstration of an interesting series of experiments upon the relative flash and danger points of mineral burning oils of Scotch, Russian, and American origin took place at Linlithgow recently. The first experiment was made with Professor Abel's regulation test apparatus, in which oil is heated in an inclosed vessel two inches in diameter until the flash point is reached. The sample tested was an American oil known as the Royal Daylight. It lighted at a temperature of 76°, or 3° above the government standard. To show the arbitrary character of the government test, a sample of the same oil was taken and placed in a vessel nine inches in diameter of exactly similar construction to that of Professor Abel, and in this case the flash point fell to 69°. Next a popular Russian oil was tested, and was found to flash with the Abel apparatus at 84°, and in the extended experiment, when the larger body of oil was used, at 79°.

Mr. Bishop, the chemist to the Linlithgow Oil Company, who conducted the experiments, next proceeded to illustrate the fire test. Filling a miner's lamp of the ordinary construction, he placed a small spirit lamp under it, applying a light to the oil repeatedly as the temperature rose. At 90° the oil flashed; at 105° it burned for a few seconds; at 110° it burned steadily until extinguished by the closing of the lamp. Subsequently the ordinary No. 1 oil of the company was tested by the regulation apparatus, a slow, tedious operation, for it did not flash until a temperature of 116° was reached. A number of Young's duplex metal lamps charged with Scotch, American, and Russian oil, which had been burning for some time, were also shown. A thermometer having been inserted into the several lamps, it was found that the temperature of both the American and Russian oils stood at 90° (or 17° above the standard), and of the Scotch oil at 88°. With a glass or a china lamp, the temperature in each case would have been several degrees lower, and it was further stated that from the construction of the lamp in ordinary circumstances no danger arose from the high temperature *per se* in the case of either of the foreign oils. In the event of an *accident* occurring, however, the results might be serious; and this Mr. Bishop next proceeded to demonstrate. Pouring a small quantity of American oil heated to 88° into a small metal cup, he applied a light and the oil immediately ignited. With the Russian oil the result was similar, though the flame did not so quickly catch the oil. Next the lighted match was thrown into Scotch oil, also heated to 88°, when the light was at once extinguished.—*Chemical Trade Journal.*

California Borax Mines.

Though every now and then reports come from the desert of rich finds of gold and silver, yet the greatest industry of Death Valley and the desert is the mining and working of borax. Twenty years ago borax was first discovered in California, west of the Slate range, seventy-eight miles from Mojave, the discoverer, John W. Searles, forming a company known as the San Bernardino Borax Mining Company, erected works which have been in constant operation ever since.

The borax in the crude state forms a crust over the marsh. This crust is removed, hauled to the works and placed in solution in immense tanks heated by steam. After allowing the solution to settle, it is drawn off into cement vats, where it is allowed to crystallize. This operation is again repeated, when the borax is ready to be sacked and shipped to market. After the removal of the borax from the marsh, crystals of tincal again begin to form, which are worked but once, when they are in a salable condition. In order to facilitate this operation, water from the marsh is pumped into large tanks, in which the tincal forms.

These works are models of mechanical construction, and are the best equipped on the desert. To the uninitiated, borax working is but a repetition of boiling, settling and crystallizing. The fuel used is crude petroleum, which is hauled in huge tanks from Mojave.

The teams used in the transportation of the refined product are curiosities in their way—a wonder to the tenderfoot and a surprise to the teamster. As these wagons are the greatest in existence, carry the heaviest loads and are seen no other place, a description is in order. The hind wheels are seven feet in diameter, front wheels five feet; hubs, eighteen inches in diameter by twenty-two inches in length; tires, six inches wide and an inch thick; steel axles, three and one-half inches in diameter; bed, sixteen feet long, four feet wide and six feet deep. Each wagon weighs about 8,000 pounds, and is capable of carrying 20,000 pounds at a load. Two wagons loaded with borax and an oil tank on a third wagon complete the train hauled by the borax team. The team consists of eighteen mules and two horses—twenty animals in all, which are driven by a bell cord, used as a jerk line. A carload (40,000 pounds) of borax is hauled each trip from the works to Mojave, and a tank of oil and two loads are hauled on the return trip.

It takes eight days to make the trip, and in nearly twenty years not a trip has been missed. Stations at which water can be had, and where feed is stored, have been erected for the borax teams to put up. The borax company has done much to assist in the development of the desert, as water is furnished free of charge at all their stations.

From the borax mine, twelve miles from Daggett, wagons of the same style and teams similar in makeup are used by the borax company. Not all the borax of Death Valley and the desert is found in marshes, and all the marshes, while having the same appearance, do not contain borax.

In Furnace Creek canon of the Funeral mountains, and in the Death Valley marsh, borax is found in the shape of cotton balls, while in the San Bernardino Company's marsh none of these are found. The cotton balls are borate of lime and are scientifically known as ulexite. On taking them from the ground they can be pulverized easily, but after exposure to the air they become very dry and hard. They become so hard that it is necessary to put them through a crusher.

For months after the discovery of borax hundreds of prospectors braved the terrors of Death Valley, and many left their bones to bleach in that terrible sink-hole. Borax was searched for in unheard-of localities, but it was only known to exist in marshes and beds of old lakes. It was not until the discovery of silver in the Calico mountains that borax was known to exist in deposits or veins. A miner, more curious than his fellows, had a piece of white looking rock assayed, and made the wonderful discovery that hundreds of prospectors had traveled over a vein of boracic acid more valuable than any marsh then known. This was a set-back to all preconceived notions of borax mining, and the supposed-to-be valueless white rock of the Calico mountains became suddenly valuable. This is only another case of where the values at home were overlooked for the much-talked-of treasures of a far-off land. The deposit at Calico is owned by the Pacific Coast Borax Company, and the product is shipped to their works at Alameda for reduction.

Another and larger deposit of the same class was found at Monte Blanco, in a branch of Furnace Creek canon, but its great distance from a railroad made the working of it an impossibility.

In Death Valley are the rotting remnants of two borax works—institutions which promised, for a time, to make their owners rich. With a fall in the price of borax and the establishment of more accessible rivals, abandonment was forced upon the owners. The works north of Furnace Creek, which were erected to utilize the product of Winter's discovery, closed in 1888, after a run of five years. The Eagle works, erected at a marsh belonging to a Frenchman named Daunet, have also been closed down for several years.

Throughout all this country, with the exception of Death Valley, may be found the stakes of the railroad surveyor, and several practical routes for a railroad have been found, though none have yet been decided upon. At the time of the discovery of borax in California, the wholesale price was 50 cents a pound. At present it is worth about 8 cents. Over 20,000 tons are used annually, about one-third of which is produced in the United Sates.

Vibrios in River Water.

A recent number of the *Arbeiten a.d. Kaiserlichen Gesundheitsamte* contains an interesting paper, by Dr. Dunbar, on the detection of cholera vibrios in river water. As many as 4,100 samples in all were examined, 855 being abstracted from the river Elbe alone, while samples from the Rhine, Weser, Oder and other rivers were also submitted to the special tests necessary for the isolation of cholera vibrios. The investigations were begun at the beginning of last August, and were continued until the middle of December. Only those vibrios which gave the cholera red reaction were submitted to further cultivation and examination. Dr. Dunbar exercises great caution in the classification of the numerous vibrios he has isolated, and although in all important respects it was impossible to distinguish them from undoubted cholera vibrios, yet he prefers to describe those obtained from the river Elbe as Elbevibrios, those from the river Rhine as Rhinevibrios, those from the river Oder as Odervibrios, and those from the river Amstel as Amstelvibrios. Some of these vibrios when cultivated in ordinary peptone broth in the presence of air and at a suitable temperature, gave rise to phosphorescence, a phenomenon which was never obtained with the cholera vibrio; but even this failed to serve as a mark of distinction, for out of 68 cultures in which this characteristic appearance was exhibited, 38 only gave it occasionally, losing this power in some instances and exhibiting it in others. Elbevibrios were detected in the vicinity of Hamburg from July 19 down to November 4; after that date, although samples were daily examined, none were found. But whereas these cholera-like vibrios were not found after November 4 in the running water, they were found more than a month later, on December 19, in the mud at the bottom of the river; the latter, remarks Dr. Dunbar, probably offering them an opportunity of remaining in a dormant condition for considerable periods of time until chance and suitable circumstances enable them to become again redistributed in the stream itself. These Elbevibrios were found on 21 occasions in the tap water as delivered to the city, and once in this water after passing through a Berkefeld cylinder, which was investigated on fifty successive days.

Petroleum in Sumatra.

The deposits of petroleum discovered a few years ago in the Province of Lanhkat, in the northern portion of the island of Sumatra, and along the coasts of the Malacca Straits, are being rapidly developed. Concessions have been granted by the Dutch Indian government to both Dutch and English capitalists, but at present only the Dutchmen have worked their concessions. The area of the lands conceded amounts to 318 square miles, and it is believed that this portion of the island is very rich in petroleum. The wells are put down very near to the coast, so that the expense of carriage and shipment is not heavy, and, as the quality of the oil is very good, it is thought Sumatra may, before very long, enter into serious competition with Russia and America, the more so as this portion of the coast possesses a deep and well-sheltered harbor.

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RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM GENERATOR.—Charles W. Vanderburgh, Seattle, Wash. This generator has at its base mud drums on three sides, one of them having the feed water inlet, and upwardly extending pipes from all the drums connecting with a steam pipe from which steam is conveyed to the place of use. Transverse coils are arranged low down in the furnace, and connect with the vertical pipes at the sides, while other pipes, above these, are centrally located and designed to contain dry steam. The generator is designed to make steam rapidly, and so dry steam will always be ready for use, with comparatively little fuel, while the blowing-off of deposits is readily effected.

COAL DUMP.—Joseph J. Lane, Nelsonville, Ohio. This device is especially designed for unloading coal or ore cars, holding the car on the tipple during the operation of unloading, and automatically releasing the loaded car as soon as a second loaded car comes on the tipple. The invention also provides for spreading the rails adjacent to the end of the tipple, avoiding the danger of clogging, etc. Vertically movable spring-actuated stop pieces proje in the path of the car wheels and hold the car on the tipple during the unloading, the stop pieces being connected with track levers actuated by the weight of the cars.

DUMPING SCOW.—William Fallon, New York City. This is an improvement on a formerly patented invention of the same inventor, for a dumping apparatus adapted for use on a scow or car, whereby the entire bottom and sides of the car may be thrown quickly into inclined position, dumping the load on two sides of the car, its upper central portion also moving outward to insure perfect dumping. The apparatus is of simple and substantial construction, and simple and convenient means are provided for throwing the car back to normal position, latches holding the sides upright when the car is loaded.

BRAKE.—Francis D. Verran, Republic, Mich. For cars used in mines working on inclined planes this brake is especially adapted. It may be applied to cars of ordinary construction or skips carrying men or material on slopes, to arrest a car or train in case the draught rope or chain breaks, the brake mechanism being brought into operation automatically by the reverse motion of the car caused by its gravity.

Railway Appliances.

TIE PLATE.—Walter H. Wilson, New York City. This plate has longitudinal ribs on its upper surface, and guards for the rail-securing spikes, the guards being separate from the plate, and fitting between the ribs, and having spike-like shanks entering the tie. It is designed to aid in preserving the ties, and effectually prevent shearing and grinding of the spikes by the rails.

SWITCH.—William C. Dillman, Brooklyn, N. Y. Two patents have been granted this inventor for an extremely simple switch and switch-working mechanism which may be readily applied to an ordinary railway, and to the usual swinging switch rail or point. It is particularly adapted for use on street railways, its operative parts being arranged beneath the roadbed and protected from snow, dirt, etc. It has but few parts, is not likely to get out of order, and may be conveniently worked from a moving car.

RAIL JOINT.—Dr. Miles O. Perkins, Galveston, Texas. According to this improvement the base plate, seated under the meeting ends of two rails, is made with inwardly projecting flanges, which reach over the base of the rail toward its web, but without touching either. These flanges of the chair afford seats for the engagement of spring side plates, in the nature of levers, their lower edges bearing upon and against the base of the rails, while a short arm bears in grooves or seats in the under side of the flanges. The side plates do not reach quite to the under side of the rail tread and are fastened together and to the web of the rail by bolts, thus clamping the rails by a spring action adapted to recover all wear. The patent is numbered 521,667, and the improvement was described in our issue of July 7.

Electrical.

ELECTROLYTICAL APPARATUS.—Oscar Knofler, Charlottenburg, Germany. According to this invention a series of electrodes consist of an insulating frame and of separate conducting plates set therein after the fashion of window panes, separate apartments being arranged between the electrodes for the reception of the electrolyte, and electrical connections to the end electrodes. By alternately arranged electrodes and frames special compartments are formed in each frame for the liquid to pass through, so that the electric current passes from one electrode through the liquid to the next following electrode, and so on, in each compartment the face of one electrode forming the anode and the opposite face of the other electrode the cathode. Very high tension currents may be used.

ELECTRIC BELT.—William E. J. Lawlor, Portland, Oregon. This belt is tubular, inclosing a series of batteries linked together, webbing being secured to the inner surface of the belt at the rear, and electrodes secured to the webbing being connected by a wire with one end of the chain of batteries, while an electrode on the front portion of the belt is connected by a wire with the other end of the chain of batteries. An auxiliary belt in the form of a loop has electrodes connected by a wire with one end of the chain of batteries. The batteries are readily removable from the belt for cleansing, and are recharged by simply dipping in a cup or bowl of the electrolyte.

Agricultural.

HAY RAKE AND LOADER.—Peter M. Thompson, Anaconda, Montana. In this machine the teeth accommodate themselves to undulating ground, and may be readily raised and lowered and adjusted to or from the elevator, adapted to carry the hay or straw from the lower to the upper portion of the loader and distribute it. The elevator is quite light, yet durable, and the hay or straw will not drop therefrom while being carried upward, while a hood over the upper portion of the machine will guide large masses of hay over the top of the elevator. The machine is of simple and comparatively inexpensive construction.

THRASHING MACHINE ATTACHMENT.—William L. Johnson and William L. Hay, Franklin, Tenn. An air blast stacking attachment has been devised by these inventors, one which can be readily connected to any of the modern thrashing machines, affording effective means for stacking the straw without the aid of elevator devices and the hands employed therewith. The blast devices are arranged to discharge a divided blast, to more effectively separate the chaff and straw from the grain at the final separating screen, and force such straw and chaff out with the bulk or heavy straw through a condensing chamber and a stacking tube.

Miscellaneous.

PROCESS OF PURIFYING GLUE.—Peter Cooper Hewitt, New York City. This invention provides a simple, inexpensive and effective method of removing impurities from glue, also easily removing the purifying agent, odor and color, and imparting to the glue high qualities. It consists in mixing casein in solution with the glue solution, the casein uniting with albuminous substances and other impurities and becoming insoluble, that the resulting coagulum may be readily removed. Albumen may also be added with the casein and the mixture heated. The glue may be bleached either before or after clarification, the casein being particularly adapted to remove color from the glue, in connection with other bleaching agents.

DISINFECTING DEVICE.—Salomon and Emil Taussig, New York City. This is a portable device to disinfect places where there are contaminating exhalations. It is compact in form and inexpensive, and continuously supplies a regulated amount of disinfecting fluid to a porous medium of considerable area exposed to air currents passing through the device, whereby the air will be impregnated with the vaporized disinfectant. The invention also provides a liquid-dropping device for disinfecting air currents, or for intermittent deposit of a disinfecting fluid in cesspools, water closets, etc.

SAWHORSE.—Charles D. Snell, Oxford, Me. In this horse the log to be sawed is supported by conical rollers of different inclinations, whereby the log may be readily moved endwise with the use of one hand, whether the log be light or heavy, and by means of a clamp operated by the foot of the sawyer the latter is permitted to stand substantially erect, and to use both hands with perfect freedom in the action of sawing.

LUBRICATOR FOR JOURNALS.—Pankratz Knauer, Elizabeth, N. J. This inventor has devised a novel arrangement of spring-supported disks whereby a single series of disks is disposed directly beneath the journal, having sufficient contact therewith to effect a perfect lubrication with a minimum of friction. The journal box is supplied with oil enough to surround the lower portions of the disks at all times.

SALIVA PUMP.—Allison R. Lawshe, Trenton, N. J. This is an apparatus for the use of doctors and dentists, for the removal of saliva from a patient's mouth while undergoing treatment. The invention consists of a receiver connected at its bottom with a pipe carrying on one end a valved mouthpiece and at its other end a discharge valve leading to an outlet pipe, an air bulb being connected by a pipe with the top of the receiver.

CLAMP.—Alta M. Cole, Asheville, N. C. This is a device more especially designed for the use of engravers, to hold plates, brushes, mirrors, and other articles to be engraved, and permit the engraver to work with greater facility. A face plate is mounted to revolve upon a base, and adjustably secured to the plate are clamp bodies with seats on their inner faces, face pieces being secured in the seats of the bodies, and there being screws for adjusting the face pieces.

HEATER.—John McLoughlin, Boston, Mass. This heater is preferably arranged as a fireplace, and is designed to use gas. The fire box in front of a hot air chamber has blocks of clay and asbestos to represent fuel, gas supply pipes opening into the lower end of the box, and from the top of the hot air chamber lead air outlets discharging into the room, or to be connected with passages to another room. The gas for combustion is mixed with air as it passes to the fire box, and the arrangement is such that either one or three flames may be kept burning.

SASH LOCK, LIFT AND BALANCE.—Onslow K. Gardner, Pittsburg, Pa. This invention is an improvement in such locks operating in connection with a rack attached to the side of a window frame. A toothed wheel is journaled in a laterally slotted case, through which projects a toothed locking pawl curved corresponding to the wheel, over which it extends, while a spiral spring bears on the shank of the pawl.

HOOK AND EYE.—Frederick W. Wall, Fort Worth, Tex. Each member of this hook and eye is made of a continuous piece of wire doubled on itself to form a base part and a return part, and upon each member at the rear are opposite side loops to be secured by stitching to a garment, while forwardly, and near the point of the meeting edges of a garment, are larger opposite branches or loops designed to prevent gaping of the dress, these branches forming an unbroken edge or continuation, and preventing the garment from being accidentally unhooked.

"VICTOR" WASHING MACHINE.—Thomas Bunker, Weeping Water, Neb. This machine has a corrugated bottom and removable corrugated sides, in connection with a simple collapsible and expansible rack. It is actuated easily by a handle lever, and arranged with pins placed in such a way that they cause the clothes in the tub of the machine to be revolved around and around against the corrugations, the rack being alternately closed and opened, and the clothes being thus thoroughly rubbed and washed without being injured.

HOT WATER BAG THERMOMETER.—Henry Weinhagen, Hoboken, N. J., and Ferdinand King, New York City. According to this invention the hot water bag is made with a tubular projection or pocket at one side leading into the interior of the bag, a tubular plug with gland fitting in the extension, while a thermometer is so secured to the bag that its bulb extends through the projection into the interior of the bag. The attachment may be made to rubber or other bags or vessels used in the irrigation of wounds, etc., before, during, and after operations.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Vol. X. New York City: Published by the Institute. 1893. Pp. x, 719.

This large, closely printed volume, to a certain extent, produces a depressing effect, as showing the immense activity now existing in the electrical field, and as indicating the necessity of constant reading and study for those who desire to keep up with the day. It is very evident that the time has come when the electrical engineer will have to submit to the mood of the day and become a specialist, not in his own science of electricity only, but in some particular branch thereof. Perhaps one of the most valuable features of these transactions, of which this is the tenth volume, are the very full discussions and communications relating to the papers which are printed immediately after each of them.

L'ALUMINUM, LE MANGANESE, LE BARYUM, LE STRONTIUM, LE CALCIUM ET LE MAGNESIUM. A. Lejeal. Introduction par M. U. Le Verrier. Paris: Librairie J. B. Bailliere et Fils. 1894. Pp. 348. Price $1.

This work is mainly devoted to one metal, aluminum, but the author has gone beyond this subject, and has added to aluminum, its treatment, and metallurgy. He devotes several chapters to manganese, barium, strontium, calcium, and magnesium. The book is illustrated and very excellently printed. It is to be noted that the chemical formulæ are all given in the old system—something which should be taken due cognizance of in perusing the book.

SCIENTIFIC AMERICAN BUILDING EDITION.

JULY, 1894.—(No. 105.)

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1. An elegant plate in colors showing a half stone and half frame summer cottage erected at a cost of $4,500. Perspective views and floor plans. Mr. H. Howard, architect, New York City. An attractive design.
2. Plate in colors showing a Queen Anne dwelling at Melrose, Pa., recently erected for W. H. Miller, Esq. Perspective elevation and floor plans. Cost $8,500. Mr. A. M. Walkup, architect, Philadelphia, Pa.
3. Full page engraving of Nonsuch Palace.
4. A half-timbered house at Rosemont, Pa., recently erected for John H. Converse, Esq., at a cost of $11,000. Perspective elevation and floor plans Mr. T. P. Chandler, Jr., architect, Philadelphia, Pa. A handsome design.
5. Engravings and floor plans of a cottage at Jamaica, L. I., recently completed for B. S. Waters, Esq. A popular design of American style. Cost $5,800 complete. Messrs. Daus & Oborne, architects, Brooklyn, N. Y.
6. Residence at Yonkers, N. Y., recently erected for Cheever N. Ely, Esq. Perspective elevations and floor plans. Mr. Augustus Howe, architect, New York. A pleasing design.
7. A dwelling at Hackensack, N. J., recently erected for Mrs. Maria Bogart. Perspective elevations and floor plans. Mr. W. L. Stoddard, architect, Tenafly, N. J. A model design.
8. A colonial cottage at Hartford, Conn., erected for W. F. Goody, Esq. An attractive design. Floor plans and perspective elevations. Cost $4,750 complete. Mr. Henry D. Hooker, architect, New York City.
9. A residence at Edgewater, Ill., recently erected for G. F. Lange, Esq. Perspective elevations and floor plans. A pleasing design.
10. A residence at Bryn Mawr, Pa., recently erected for Prof. Herbert W. Smyth. Three perspective elevations and floor plans. Cost complete, $6,500. Mr. J. C. Worthington, architect, Philadelphia, Pa.
11. A picturesque country cottage at Greenwich, Conn. Perspective elevations and floor plans. Messrs. A. H. Throp & W. S. Knowles, architects, New York City. An attractive design.
12. Design for a stairway.
13. Miscellaneous Contents: The passing of the carpet, illustrated.—Why not remodel the old home? illustrated.—Mott's "Sunray" steam boiler, illustrated.—Modern brick machinery.—The "Ideal" sash pulley, illustrated.—Improved wood working machinery, illustrated.—Elevators for the New Commercial building, Philadelphia.—Architectural wood turning, illustrated.—The Beveridge cooker, illustrated.—The Variety wood worker, illustrated.—The "Monarch" fireproof partition, illustrated.—View of the Hotel Phœnix, Winston, N. C.

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Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

"U. S." metal polish. Indianapolis. Samples free.

Wanted—A sandblast machine for obscuring sheet glass. F. J. Riester, 29 Pearl Street, Buffalo, N. Y.

Distance Reading Thermometers.—See illus. advertisement, page 32. Ward & Doron, Rochester, N. Y.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

Patent for Sale—Wire implement, useful in all fruit and agricultural sections. M. S. Moremen, Switzerland, Florida.

Emerson, Smith & Co., Ltd., Beaver Falls, Pa., will send Sawyer's Hand Book on Circulars and Band Saws free to any address.

Split Pulleys at Low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The Carter Pressure Water Filter and Purifier, for hotels, factories, etc. See illustrated adv., page 47. Field Force Pump Co., Lockport, N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

Patent Electric Vise. What is claimed, is time saving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

"Coal Oil Johnny's" petroleum soap removes ink and grease from printers' and mechanics' hands. Unsurpassed also for toilet use. Used by U. S. government. Sold by M. Jenkins, 124 Warren Street, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6164) E. B. T. asks: What is the best method of annealing toolsteel? A. Slow cooling of tool steel buried in hot ashes or lime from a full red heat is the approved way of annealing for ordinary use. For producing an extra soft steel for die sinkers' and punch cutters' use, the steel is taken from the ash or lime bath just as the red heat has disappeared and plunged in water. This is called water annealing and makes the steel soft and suitable for delicate chiseling and engraving.

(6165) A. M. W. says: Will you please tell me how to make an inking pad for a rubber stamp? A. The following is said to be a cushion that will give color permanently. It consists of a box filled with an elastic composition, saturated with a suitable color. The cushion fulfills its purpose for years without being renewed, always contains sufficient moisture, which is drawn from the atmosphere, and continues to act as a color stamp cushion so long as a remnant of the mass or composition remains in the box or receptacle. This cushion or pad is too soft to be self-supporting, but should be held in a low, flat pan, and have a permanent cloth cover. The composition consists preferably of 1 part gelatine, 1 part water, 6 parts glycerine, and 6 parts coloring matter. A suitable black color can be made from the following materials: 1 part gelatine glue, parts lampblack, aniline black, or a suitable quantity of logwood extract, 10 parts of glycerine, 1 part absolute alcohol, 2 parts water, 1 part Venetian soap, ½ part salicylic acid. For red, blue, or violet, 1 part gelatine glue, 2 parts aniline of desired color, 1 part absolute alcohol, 10 parts glycerine, 1 part Venetian soap, and ½ part salicylic acid.

(6166) J. T. V. says: Will you please tell me what kind of paint I can use on old developing trays? A. Use asphaltum varnish, or coat the bottom or sides of the wooden tray with

	By weight.
Resin	1 part.
Beeswax	2 "
Paraffine	3 "

Melt the above first, warm the tray, and while hot apply composition with a brush.

(6167) S. W. R. asks where to get a very sensitive and not too expensive galvanometer. I have several catalogues from dealers, but the instruments are all very expensive. I require an extremely sensitive instrument, that is to say, I need an instrument that will detect extremely weak currents, but not costing more than $12 to $15. A. You can procure a galvanometer of this kind from dealers in electrical goods who advertise in our columns, or you can readily make a galvanometer of this kind. You will find directions in the SUPPLEMENT.

(6168) S. J. M. asks: 1. Will a telephone not using a battery work through one wire, having ground connection for return current, say a 1 mile line? A. Yes. 2. How can the zinc in a gravity bat-

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tery be preserved when the battery is not in use for some time? A. By removal from the solution. 3. What apparatus can be put into a telephone circuit to ring bells in two rooms? A. A magneto-electric machine. 4. What cheap work on the setting up and working of telephones would you recommend to beginners? A. "Practical Telephone Handbook." By Poole. $1 by mail.

Communications Received.

"On Forms of Matter and Energy." By C. P. S.

"Lime and Fertilizers." By W. F. M.

"On a Proposed Ship Canal." By I. B.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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AND EACH BEARING THAT DATE.

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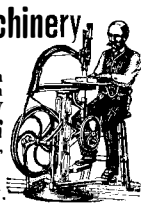

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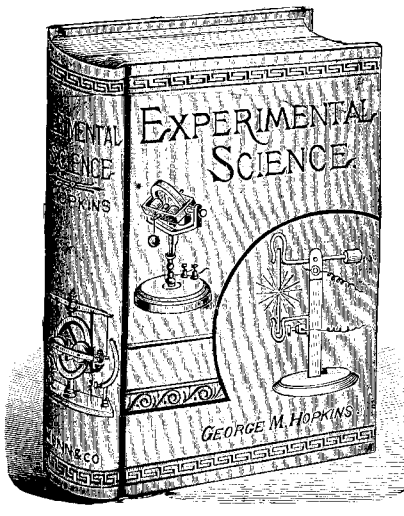

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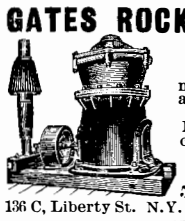

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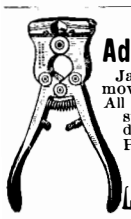

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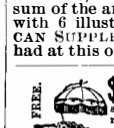

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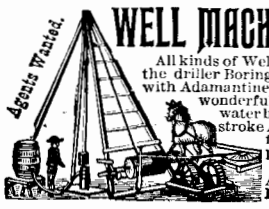

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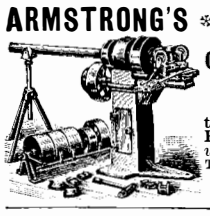

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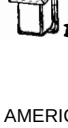

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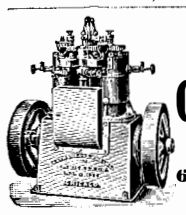

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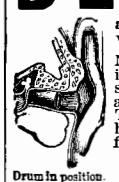

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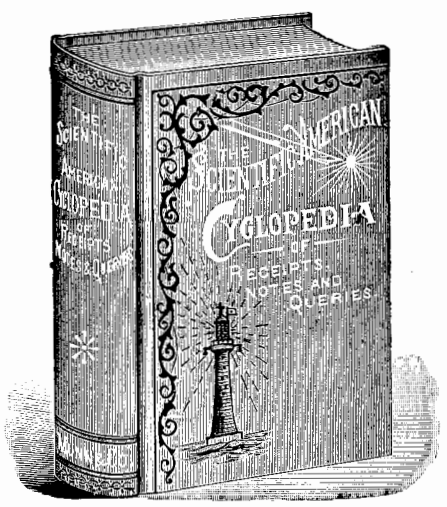

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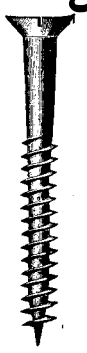

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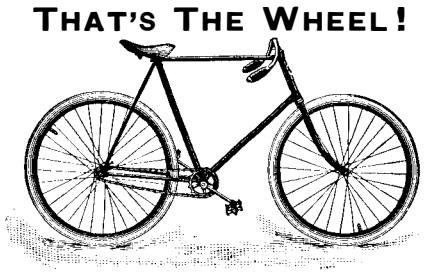

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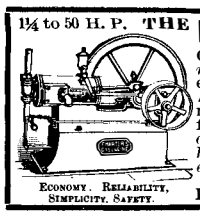

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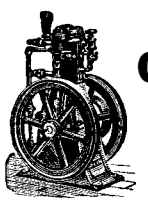

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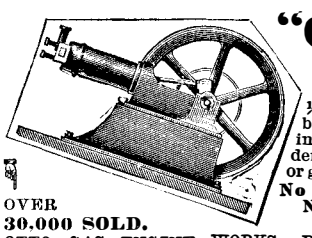

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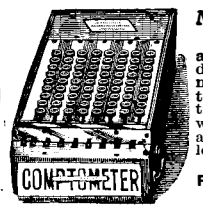

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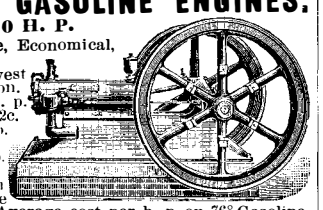

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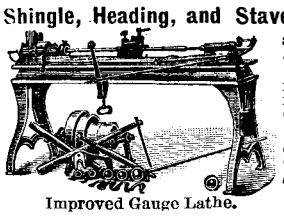

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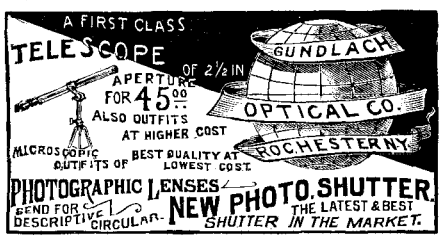

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